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This report has been assigned to the ENVIRONMENTAL PROTECTION TECHNOLOGY series. This series describes research performed to develop and demonstrate instrumentation, equipment, and methodology to repair or prevent environmental degradation from point and non-point sources of pollution. This work provides the new or improved technology required for the control and treatment of pollution sources to meet environmental quality standards.

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February 1977

OIL SPILL AND OIL POLLUTION REPORTS

August 1976 - October 1976

by

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Grant No. R803992

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other material relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin designed to review current scientific and technical publications and research projects in the field of oil pollution. Subject coverage includes all aspects of aquatic and terrestrial oil pollution. This issue contains summaries of research projects and publications selected from the scientific and technical literature during the period August, 1976 through October, 1976.

The following sections are included in the report:

I. Reports, Publications, and Patents
II. Current Research Projects
III. Current Oil-Related Conferences

This report is submitted in partial fulfillment of EPA Grant No. R803992-01 by the Marine Science Institute, University of California, Santa Barbara, California, under the sponsorship of the Environmental Protection Agency.

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16. ABSTRACT

The August 1976 - October 1976 Oil Spill and Oil Pollution Reports is the ninth quarterly compilation of oil spill events and oil pollution report summaries. Presented in the report are: (a) summaries of oil spill events; (b) summaries and bibliographic literature citations; (c) summaries of current research projects; and (d) patent summaries. This report is submitted in partial fulfillment of EPA Grant No. R-803392 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the Environmental Protection Agency.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*Bibliographies *Summaries *Patents *Documents *Research	Oil pollution Oil spill events Oil spill research Oil pollution control Oil pollution patents	13B

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INTRODUCTION

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin which reviews pertinent scientific and technical publications and research projects to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, documents, and other materials relating to oil pollution published during the period 1974 to 1976 (Section I); summaries and status of current research projects (Section II); and current oil-related conferences (Section III).

The subject coverage includes all aspects of aquatic and terrestrial oil pollution. Items in Section I are categorized by seven major subdivisions divided into thirty specific subject categories. These are presented in the Table of Contents. Patents and patent applications are announced in this section under appropriate subject categories. Sources of the citations appear in the list of Periodicals Reviewed in the Appendix. A subject keyword index of entries in Section I is provided at the end of the report.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications provided upon request by the principal investigators or performing organization. Notices of research projects were obtained from the Smithsonian Science Information Exchange (SSIE); American Society for Microbiology, Aquatic Microbiology Newsletter; and Canada, Department of the Environment, Spill Technology Newsletter. Entries are arranged according to the same subject categories as in Section I and are ordered by serial number within each subject division. Some of the current projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted and headed by the same serial number as originally reported, followed by the word (renewal). Renewal entries are listed at the beginning of each subject category.

Section III, Current Oil-Related Conferences, contains descriptive information on recently held and upcoming conferences relevant to any aspects of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of conference papers are included. All information for this section was obtained from the periodicals reviewed (Appendix) and from responses to written inquiries concerning the meetings.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following: C, reports, publications, and patents; and R, research projects.

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-1740-76
1975 ACOPS REPORT
Anon. 1976.
Marine Pollution Bulletin 7(6):100-101.

Oil spills, Statistics, Liability, Government agencies, England, *ACOPS

The 1975 annual report of Britain's Advisory Committee on Oil Pollution (ACOPS) is discussed. In addition to its usual review of oil spills and other oil pollution incidents, the report makes recommendations regarding the British government's pollution liability policies, the state of hydrographic research, and the congested English Channel shipping lanes.

C-1741-76
ANOTHER TORREY CANYON?
Anon. 1976.
Marine Pollution Bulletin 7(7):123-124.

Oil spills, Tankers, Spain, Fisheries, Beaches, Cleanup, *Coruna oil spill

The Urquiola, a Bilbao-registered tanker carrying about 100,000 tons of oil, went aground at Coruna in northern Spain, and ruined miles of beaches and fisheries. Oil dispersants were sprayed using helicopters, but a large portion of the spill has not yet been recovered.

C-1742-76
THE GOWANUS CANAL OIL SPILL (news brief)
Anon. 1976.
JBF Scientific Corporation, Wilmington, MA. U.S. Coast Guard Contract DOT-CG03-6666

Oil spills, Fuel oil, Cleanup, Recovery, Skimmers, *Gowanus Canal

Approximately 9.8 million liters (2.6 million gallons)of No. 2 and No. 6 fuel oils were spilled at Gowanus Canal. Two oil skimmers manufactured by the JBF Scientific Corporation were used in cleanup operations and recovered nearly 5.7 million liters (1.5 million gallons) of the spilled oil.

C-1743-76
GUDE CHARGES COAST GUARD WITH VIOLATING FEDERAL REGULATIONS; RADM. PRICE RESPONDS
Anon. 1976.
Sea Technology 17(8):47-51.

Oil spills, Fuel oil, Chesapeake Bay, Regulations, U.S., *U.S. Coast Guard

The Coast Guard was charged with violating federal oil spill regulations by Congressman G. Gude when a barge sank on February 2, 1976, in Chesapeake Bay spilling nearly 950,000 l (250,000 gal) of No. 6 fuel oil. The charges against the Coast Guard and suggestions for improving the protection of Chesapeake Bay are given; a response from the Coast Guard is also reported.

C-1744-76
IOPEC HAMBURG 1976 (news brief)
Anon. 1976.
Marine Pollution Bulletin 7(7):123.

International conventions, Germany, West, Oil spills, Cleanup, Containment

Topics to be covered at the 1st European and International Oil Pollution Exhibition and Congress in Hamburg, 21 to 25 September, 1976, are presented. Information on all aspects of oil pollution, including disasters in the open ocean and in inland waterways, will be provided. Equipment and materials used for dealing with oil spills will be on display.

C-1745-76
NATURAL OIL SEEPS FLOW 550,000 TONS PER YEAR INTO SEAS (news brief)
Anon. 1976.
Offshore 36(10):100.

Natural seepage, Oceans, Offshore production, *NOAA

"The U.S. National Oceanic and Atmospheric Administration estimates oil from natural seeps underlying the world's oceans enters the marine environment at a rate of more than 550,000 tons per year, and that offshore petroleum production adds 1,100,000 tons to that figure."

C-1746-76
THE OIL POLLUTION LOBBY
Anon. 1976.
Marine Pollution Bulletin 7(6):97-99.

Pollution prevention, Oil spills, Law enforcement, England, *ACOPS

The article reviews the history and development of Britain's Advisory Committee on Oil Pollution of the Sea (ACOPS). Since its inception in 1952, ACOPS has evolved into an influential, broadly supported and respected advisory body which seeks to stimulate public and governmental awareness of oil pollution problems and to promote the vigorous enforcement of national and international antipollution legislation and agreements.

C-1747-76
PRELIMINARY REPORT ON CONTAMINATION OF UNDERGROUND-WATER SOURCES BY REFINED PETROLEUM PRODUCTS
Anon. 1976.
Ground Water 14(1):36-44.

Contamination, Groundwater, Oil tanks, Leakage, Regulations, Pollution prevention

Hazards, sources, local incidence, remedial action, and current regulatory control of groundwater contamination due to petroleum spillage or leakage are discussed. Preventive measures include the use of underground storage tanks, detection of leaking tanks, and control over existing tanks.

[from Biological Abstracts 61(11):#63328. 1976]

C-1748-76
SLOW REACTION TO EMERGENCY INTENSIFIED CHESAPEAKE SPILL (news brief)
Anon. 1976
National Fisherman 57(4):17A-18A.

Cleanup, Oil spills, Pollution prevention, Chesapeake Bay, *U.S. Coast Guard

Partial proceedings of the Congressional hearing on the Chesapeake oil spill of February 2, are given. The hearing was called to evaluate the U.S. Coast Guard's response to an emergency. The following points were brought out: (1) the Coast Guard did not conduct a complete aerial survey until 60 hours after the spill; (2) no Coast Guard cutter was dispatched for salvaging purposes; (3) the U.S. Fish and Wildlife Service was not notified of the spill until four days later. Cleanup costs and some preventive measures are reported.

C-1749-76
WASTE OIL (news brief)
Anon. 1976.
Audubon 78(5):121.

Waste oil, Oil discharges, U.S., Economics

Due to the small number of oil re-refiners in the U.S., the amount of waste oil that is dumped into rivers, lakes, and oceans has increased to 984 million liters/year (260 million gal/year). However, the situation for re-refining oil is improving as oil prices continue to rise.

C-1750-76
SCIENCE'S CIA
Berg, P. 1976.
The Sciences 16(1):27-28.

Oil spills, Information systems

The Center for Short-lived Phenomena, Cambridge, Massachusetts, gathers and disseminates information on transitory natural events of scientific interest and is also the world's primary repository for oil spill information. The Center has established a computerized data base and keeps detailed records of all major spills since 1968. Until 1976 this record included all spills in the ≥ 38,000 l (10,000 gal) category. Since 1976 only those in the ≥ 95,000 l (25,000 gal) category are listed. The Center publishes an annual report of pollution events in addition to its regular reports of transitory events.

C-1751-76
SEABIRDS AND OIL POLLUTION
Brown, R.G.B. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 44-46.

Birds, Oil spills, Biological effects, *Mortality

The "Arrow" and "Irving Whale" spills in February, 1970, resulted in the known deaths of 1,500 ducks and alcids and an estimated total kill of about 12,000 birds. The field techniques in reaching these estimates are described and the significance of the mortality of the bird species is assessed.

[from Petroleum Abstracts 16(28):#221,963. 1976]

C-1752-76
OIL AND THE CANADIAN ENVIRONMENT PAPER PACE AND ITS R & D COMMITTEE
Buxton, H.L. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 3-6.

Environmental protection, Conservation, Oil industry, Canada, *PACE

The goals and activities of PACE, the Petroleum Association for the Conservation of the Canadian Environment, are described. PACE is an association of 11 Canadian oil companies with the objectives of cooperating in the development of practices, procedures and regulations pertinent to environmental conservation, supporting research in areas of conservation of the Canadian environment, and collecting and disseminating information relating to these environmental areas.

[from Petroleum Abstracts 16(28):#221,957. 1976]

C-1753-76
QUANTITATIVE ESTIMATES OF PETROLEUM TO THE OCEANS
Charter, D.B., R.A. Sutherland, and J.D. Porricelli. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 6a-30.

Oil discharges, Oceans, Source identification, Tankers, Ships

Estimates from ten of the most important information sources on annual discharges of oil into the sea were tabulated. The sources of oil were broken down into four main categories: tank cleaning and ballasting operations by tankers, other tanker operations including terminal operations, ship accidents and non-ship sources. The total of these sources is estimated to be about 3.5 million metric tons per annum.

[from Selected Water Resources Abstracts 9(10):W76-05137. 1976]

C-1754-76
FISHERMEN WIN ROUND AGAINST OIL (editorial)
Cole, B.J. 1976.
National Fisherman 57(4):6A.

State governments, Alaska, Environmental protection, Oil-gas leasing

The Alaska legislature has just voted to buy back $25 million in oil and gas leases sold by the state due to an oil spill and pressure from local fishermen. A brief history of the fishing industry's effort to save Cook Inlet and Kachemak Bay is given.

C-1755-76
A SUMMARY OF THE OIL POLLUTION ACTIVITIES OF THE ENVIRONMENTAL PROTECTION SERVICE, ATLANTIC REGION
Cook, R.H., H.A. Hall, and R.P. Cote. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 7-11.

Environmental protection, Canada, Atlantic Ocean, Government agencies, *Environmental Protection Service

The Environmental Protection Service (EPS) plays an important advisory role in environmental matters and attempts to maintain an awareness of the nature and magnitude of the problems related to environmental contamination. This paper discusses the current EPS oil pollution assessment, prevention, and control activities underway in the Atlantic region.

[from Petroleum Abstracts 16(28):#221,976. 1976]

C-1756-76
OLYMPIC ALLIANCE OIL SPILLAGE
Dixon, T.J., and T.R. Dixon. 1976.
Marine Pollution Bulletin 7(5):86-90.

Oil spills, English Channel, Cleanup, Biological effects

A tanker collision resulted in widespread oil pollution damage in the English Channel and along England's coastline. The emulsifier BP 1100X was used at sea to clean up the oil and beaches were sprayed with a dispersant. Oil skimmers were also used. Cleanup operations for the 3,000 ton crude oil spill lasted three weeks; extensive damage was done to sea birds, inshore fishery equipment, beaches, and nuclear power stations.

C-1757-76
INPUT OF PETROLEUM TO THE MARINE ENVIRONMENT DIRECTLY FROM THE ATMOSPHERE
Feuerstein, D.L. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 30a-38.

Hydrocarbons, Oceans, *Petroleum hydrocarbon emission

Total worldwide emission of petroleum hydrocarbons is estimated to be 68 million metric tons per year, of which transportation comprises about two-thirds. The total amount of these hydrocarbons reaching the oceans via the atmosphere is estimated to be about 0.4 to 0.8 million metric tons per year as compared to 2 to 3 million metric tons per year from other sources such as tanker operations, accidental spills, terminal and transfer operations, and offshore oil production.

C-1758-76
OIL ACCIDENTS DESPITE SAFETY SYSTEMS [in German]
Guldener, H. 1975.
Gesundheitstechnik 9(1):3-5.

Leakage, Oil tanks, Switzerland

Four cases of accidents with oil tanks in Switzerland leading to the release of large quantities of oil are described in detail and analyzed as to their causes.

[from Environmental Health and Pollution Control 9(3):#846. 1976]

C-1759-76
SURVEY OF PRESENT KNOWLEDGE AND DISCUSSION OF INPUT OF PETROLEUM TO THE MARINE ENVIRONMENT IN SWEDEN
Hallhagen, A. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 38a-49.

Oil spills, *Oil loss, Sweden

It was calculated that the total loss, spill, and evaporation of petroleum products in Sweden amount to about 0.5 - 0.7% of the total oil consumption, or 150,000-200,000 cu.m/year. An explanation to how much of Sweden's estimated loss of petroleum products enters the environment cannot be given at present.

[from Selected Water Resources Abstracts 9(11):#W76-05139. 1976]

C-1760-76
GREAT PATAGONIAN OIL SPILL
Hayes, M.O., E.R. Grundlach, and R.M. Perhac. 1976.
American Association of Petroleum Geologists Bulletin 60(4):678. Abstract.

Oil spills, Tankers, Environmental effects, Metula oil spill, Magellan, Strait of

The report represents a preliminary assessment of the effects of the VLCC Metula oil spill disaster, which occurred in the Straits of Magellan on August 9, 1974. Fifty-one thousand tons of Saudi Arabian crude and 2,000 tons of Bunker C fuel oil were released, of which about 40,000 tons are estimated to have been deposited along shores of Tierra del Fuego with severe biological impact. The site is considered suitable for an analog study of physicochemical and biologic effects of a spill; and the results would be useful in planning for U.S. coastal oil operations and their possible environmental effects.

[from Petroleum Abstracts 16(27):#221,566. 1976]

C-1761-76
APPLICATION OF GROUND-WATER FLOW THEORY TO A SUBSURFACE OIL SPILL
Holzer, T.L. 1976.
Ground Water 14(3):138-145.

Oil spills, Groundwater, Source identification, Cleanup

Fuel oil underlying approximately 1.6 hectares was discovered floating on the water table beneath oil products' storage tanks. Over 132,000 l of oil were intercepted and contained prior to field investigations by borings. Field investigations and considerations to determine the nature and source area of the spill as well as appropriate spill cleanup techniques are discussed.

[from Petroleum Abstracts 16(28):#221,963. 1976]

C-1762-76
PREVENTION AND ELIMINATION OF OIL AND GAS BLOWOUTS [in Russian]
Igrevskii, V.I., and K.I. Mangushev. 1975.
UCRL-TRANS-10928, NTIS. 97p. (Translated from Preduprezhdenie i Likvidatsiya Neftyanyikh i Gazovykh Fontanov, 1974. p. 131-189.)

Blowout prevention, Oil wells, USSR, *Nuclear explosion

A detailed report and analysis is given of a runaway blowout of an oil well in the USSR. Current methods of stopping blowouts were tried and all failed; an underground nuclear explosion was ordered to shut off the shaft at a great depth. Methodology in the placement and detonation of the explosives is described and a program for the elimination of blowouts is discussed.

[from Nuclear Science Abstracts 33(10):#23247. 1976]

C-1763-76
OIL SPILL IN THE LACCADIVES FROM THE OIL TANKER "TRANSHURON"
Qasim, S.Z., P.N. Nair, and P. Sivadas. 1974.
Mahasagar 7(1-2):83-90.

Oil spills, Toxicity, Reefs, Indian Ocean

Summary not available.

[from Underwater Information Bulletin 8(2):#7604/1307. 1976]

C-1764-76
SURVEY FOR THE U.S. COAST GUARD OF RESEARCH ON THE DETECTION, IDENTIFICATION AND QUANTIFICATION OF OIL SPILLS
Rappoport, H., M. Harmon, and R. Dayton. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 23-24.

Detection, Source identification, Oil spills, *Research survey

The role of Operations Research, Inc. (ORI) in the U.S. Coast Guard Transportation Induced Pollution Surveillance (TIPS) program is to identify who is doing research in oil spill detection, identification, forecasting, and quantification. The final result will be to determine the level of research and progress in each area. A summary of projects that have been identified by this research is listed.

[from Petroleum Abstracts 16(28):#221,968. 1976]

C-1765-76
PELAGIC TAR IN THE NORWEGIAN COASTAL CURRENT
Smith, G.B. 1976.
Marine Pollution Bulletin 7(4):70-72.

Sampling, Tar, Norwegian Sea

Petroleum particulates were found in 117 of 220 neuston samples collected in the Norwegian Coastal Current during March - August, 1975, at an average concentration of 0.11 mg/m^2. Highest concentrations were observed in the Skagerrak and Barents Sea. Lower densities occurred along the northwest Norwegian coast and in the North Sea.

C-1766-76
PETROLEUM INPUTS TO THE MARINE ENVIRONMENT FROM LAND SOURCES
Storrs, P.N. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973.
Washington, D.C., National Academy of Sciences. Vol. 1. p. 49a-58.

Wastewaters, Oil discharges, Coasts, Oceans, *Municipal and industrial inputs

This paper is concerned with estimating the quantities of petroleum products entering coastal waters from municipal and industrial wastewaters, urban storm drainage, and surface water discharges. Nationwide and worldwide estimates of municipal and industrial inputs of petroleum to the oceans are given.

[from Selected Water Resources Abstracts 9(11):#W76-05140. 1976]

C-1767-76
MARINE ENVIRONMENTAL PROTECTION PROGRAM: AN ANALYSIS OF MISSION PERFORMANCE
U.S. Coast Guard, Marine Environmental Protection Division. 1976.
Report USCG-WEP-1-76.

Environmental protection, Statistical analysis, Guidelines, *U.S. Coast Guard

"This report analyzes USCG oil pollution statistics and establishes effectiveness measures and performance standards for the USCG Marine Environmental Protection program."

[from Government Reports Announcements 76(15):#AD-A025325/2GA. 1976]

C-1768-76
SS C.V. SEA WITCH-SS ESSO BRUSSELS (BELGIUM); COLLISION AND FIRE IN NEW YORK HARBOR ON 2 JUNE 1973 WITH LOSS OF LIFE
U.S. Coast Guard. 1975.
Marine casualty report, USCG/NTSB-MAR-75-6. 74p.

Oil spills, Ships, Tankers, Beaches, Crude oil, New York

Steering failure in the SS C.V. Sea Witch caused it to collide with the SS ESSO Brussels, a crude oil tanker. Nearly 5 million liters (31,000 barrels) of oil were ignited and the resulting fire killed 16 men. Nearby beaches were polluted and damages amounted to $23 million.

[from Government Reports Announcements 76(9):#AD-A021 429/6GA. 1976]

C-1769-76
ESTIMATE OF ANNUAL INPUT OF PETROLEUM TO THE MARINE ENVIRONMENT FROM NATURAL MARINE SEEPAGE
Wilson, R.D. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 58a-96.

Natural seepage, Oceans

This paper presents an estimate of yearly oil input into the oceans from naturally occurring marine seepage. Based on geologic considerations, the probable range of seepage is 0.2 to 6.0 million metric tons per year.

[from Selected Water Resources Abstracts 9(11):#W76-05141. 1976]

C-1770-76
ESTIMATES OF ANNUAL INPUT OF PETROLEUM TO THE MARINE ENVIRONMENT FROM OFFSHORE PRODUCTION OPERATIONS
Wilson, R.D. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 96a-110.

Oil spills, Leakage, Oceans, Offshore production

The total input of oil entering the sea from offshore drilling and production operations is estimated at 0.08 million metric tons per year worldwide.

[from Selected Water Resources Abstracts 9(11):#W76-05142. 1976]

C-1771-76
THE ALERT BAY OIL SPILL: A ONE-YEAR STUDY OF THE RECOVERY OF A CONTAMINATED BAY
Wong, C.S. 1974.
Pacific Marine Science Report No. 74-9.

Oil spills, Restoration, *Alert Bay oil spill

Summary not available.

2. MONITORING

C-1772-76
ANALYZER PREVENTS OIL SPILLS (product information)
Anon. 1976.
Oil and Gas Journal 74(33):148.

Wastewaters, Refineries, Oil transfer, Offshore drilling, Oil spills, Pollution prevention

A new analyzer, OCMA-32, prevents oil spills by monitoring effluents from refineries, oil-transfer facilities, offshore drilling platforms, or oil-water separators. It accurately measures total concentration of oils and greases in water and has a built-in alarm system. FFI contact Horiba Instruments Inc., 1021 Duryea Ave., Irvine, CA 92714.

C-1773-76
ASSESSMENT OF THE COAST OF WALES IN TERMS OF NATURE CONSERVATION
Anon. 1975.
Nature Conservancy Council Wales, Report.

Coasts, Wales, Conservation, Offshore development

The biological, geological, and physiographical features on the coast of Wales which are of importance in terms of nature conservation were evaluated. A survey was made to make available information necessary for nature and conservation aspects to be considered in the event of offshore oil discoveries and subsequent coastal development.

[from Offshore Abstracts 3(2):#76-1644. 1976]

C-1774-76
INTERNATIONAL CONFERENCE ON ENVIRONMENTAL SENSING AND ASSESSMENT, LAS VEGAS, NEVADA, SEPTEMBER 14-19, 1975, PROCEEDINGS. VOLUMES 1 & 2.
Anon. 1976.
New York, Institute of Electrical and Electronics Engineers, Inc., 1976. Vol. 1. 569p.; Vol. 2. 600p.

Detection, Remote sensing, *Oil pollutants, Design and engineering, Toxicity

Topics of papers include the detection and monitoring of environmental pollutants including oil. Development and design of pollution detection systems, surveillance programs, and compliance monitoring systems are also covered. Other papers examine the toxicity of various pollutants and their effects and interactions with the atmosphere, soil, groundwater and marine waters.

[from International Aerospace Abstracts 16(11):#25933. 1976]

C-1775-76
MONACO WORKSHOP ASSESSES POLLUTION MONITORING PROJECT (news brief)
Anon. 1976.
IMS Newsletter No. 12:1.

Oil slicks, Tar, Oceans, Beaches

An international workshop of experts was held in Monaco, 14-18 June, 1976, to evaluate the IOC-WMO pilot project on marine pollution (petroleum) monitoring. The project, which had been in progress 18 months, includes observation of oil slicks and other floating pollutants, collection of tar balls, studies of tar thrown up on beaches, and dissolved hydrocarbons in surface waters. Recommendations made at the workshop are briefly discussed.

C-1776-76
MONITORING OF EFFLUENT STREAMS
Anon. 1974.
Food Technology 28(2):64.

Wastewaters, *UV absorption

A method for monitoring effluent streams using a Dispersed Oil in Water Monitor, was developed by C-E Invalco, Tulsa, Oklahoma. The monitor's dual-beam-light measuring system continuously monitors the UV absorption rate in a stream and provides an accurate determination of oil contained in water by detecting variations in absorption.

[from Selected Water Resources Abstracts 9(9):#W76-04187. 1976]

C-1777-76
SHIPBOARD OIL-IN-WATER CONTENT MONITOR BASED ON SMALL ANGLE FORWARD LIGHT SCATTERING
Batutis, E., and F. Calello, Jr. 1975.
Final report, USCG-D-35-76, Contract DOT-CG-32370-A. 185p.

Design and engineering, *Oil-in-water monitor

The development and evaluation of an on line Oil-in-Water Content Monitor based on optical scattering is presented. Tests for interferences were conducted and particulate matter was found to be the only serious interference. Tolerance levels range from ± 10% to ± 33% depending upon oil types and mixtures.

[from Government Reports Announcements 76(11):#AD-A022 895/76A. 1976]

C-1778-76
DETECTION OF OIL IN SEWERS
Bock, D.H., and E.H. Eckert. 1976.
Final report, EPA/600/2-76/027. 34p.

Detection, Waste oil, Analytical techniques, *Sewage

Methods capable of measuring quantities of oil as small as those in a surface active film to massive accumulations in waste water were selected and tested. Because thick oil can be measured by electrical and thermal conductivity devices which require little maintenance in sewer use, more techniques can be adapted to thick oil than thin oil detection problems.

[from Government Reports Announcements 76(8):#PB-249 359/1GA. 1976]

C-1779-76

BARIUM IN SOUTHERN CALIFORNIA COASTAL WATERS: A POTENTIAL INDICATOR OF MARINE DRILLING CONTAMINATION

Chow, T.J. 1976.
Science 193 (4247):57-58.

Contamination, OCS, Offshore drilling, Southern California, *Barium concentrations

The present barium content of Southern California coastal waters was determined to range from 11 to 22 ug per kg of seawater. These values may be useful in establishing baseline concentrations for monitoring marine contamination during future offshore drilling and exploration activities by the oil and gas industry.

[from Petroleum Abstracts 16(32):#223,474. 1976]

C-1780-76

FLUORESCENCE MEASURING PROCESS FOR DETECTING SMALL QUANTITIES OF OIL IN LYES AND WASTE WATERS USING THE SPEKOL SPECTROCOLORIMETER

Czembor, R. 1975.
Jena Review 20(5):238-243.

Wastewaters, Fuel oil, *Fluorescence

In wastewater, diesel oil ($\leq$ 1000 mg/l) was detected by measuring the fluorescence at the 328-340 nm double band or 400 nm single band upon excitation at 270 or 345 nm, respectively. To detect diesel oil in industrial KOH solutions, 50-100 mg/l Fluorol Gruengold was added per one liter of diesel oil and excitation at 467 nm was used. A continuous, automated flow through mode of analysis is described.

[from Chemical Abstracts 84(24):#173378s. 1976]

C-1781-76

ECOLOGICAL MONITORING OF OIL INDUSTRY OPERATIONS

Cowell, E.B. 1975.
Proceedings of the Challenger Society 4(6):266-267.

Biological effects, Biomass, Plankton, Oil industry, England

The British Petroleum Company's program for assessing the environmental impact of its operations is reviewed. Data collected include abundance of planktonic species, size and growth performance, breeding, and recruitment success, biomass, productivity and diversity. These studies are to provide management with information to assess levels of environmental protection.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q3184. 1976]

C-1782-76
THE USE OF ACCUMULATOR ORGANISMS IN A MONITORING SYSTEM FOR CHEMICAL CARCINOGENS IN COASTAL WATERS
Dunn, B.P., and H.F. Stich. 1975.
Pacific Science Congress, 13th, 1975. Vancouver, University of British Columbia, 1975. Vol. 1. p. 20. Abstract.

Contamination, Marine organisms, Sediments, Carcinogens, PAH, Chromatography, *Mussels

Contamination of marine organisms and sediments by carcinogenic and mutagenic polycyclic aromatic hydrocarbons (PAH) was examined using gas chromatography. Mussel contamination by benzo [a] pyrene (B[a]P) is closely related to the degree of human activity near the sampling site. The use of mussels in a large scale screening program for carcinogens in the marine environment is discussed.

[from Oceanic Abstracts 13(4):#76-03551. 1976]

C-1783-76
HYDROCARBON UPTAKE AND LOSS BY THE MUSSEL MYTILUS EDULIS
Fossato, V.U., and W.J. Canzonier. 1976.
Marine Biology 36(3):243-250.

Hydrocarbons, Fuel oil, Biological effects, Mollusks, **Mytilus edulis*

The uptake and elimination of diesel fuel hydrocarbons by the blue mussel *Mytilus edulis* was monitored over a period of up to 41 days. The mussels accumulated hydrocarbons in their tissues in excess of 1000 times the exposure dosage of 200-400 μg/l. After termination of the dosage, rapid depuration occurred during the first 15-20 days, and significant fractions were still recovered after 32 days. Definite signs of physiological stress accompanied the hydrocarbon accumulation, but the mussels recovered quickly after termination of dosage. The suitability of mussels for monitoring chronic hydrocarbon pollution is discussed.

C-1784-76

DEVELOPMENT OF BUOY MOUNTED HYDROCARBON VAPOR SENSORS FOR USE IN LOCAL AREA POLLUTION SURVEILLANCE SYSTEM

Goodson, L.H., W.B. Jacobs, and S. Puent. 1975.
Interim report, USCG-C-10-76. Contract DOT-CG-34320-A. 112p.

Detection, Oil spills, Hydrocarbons, Design and engineering

Hydrocarbon vapor sensing on buoys along watercourses for the signalling of oil spills on a real time basis has been investigated. Three sensors were tested under laboratory and field conditions; recommendations for further evaluation of the sensors are made.

[from Government Reports Announcements 76(11):#AD-A022 855/1GA. 1976]

C-1785-76

SHIPBOARD OIL-IN-WATER CONTENT MONITOR BASED ON LIGHT-SCATTERING AT 45 DEG., 90 DEG. AND 135 DEG. AND TURBIDITY AT 0 DEG.

Hadermann, A.F., and J.H. Bockinski. 1976.
Final report, USCG-D-25-76, Contract DOT-CG-34170-A. 169p.

Bilges, Ships, Design and engineering

A breadboard oil-in-water content monitor developed for shipboard applications consists of a sample handling system for homogenizing the oil, and a unique multiangle scattered-light and turbidity sensor. The monitor response is linear from 0 to more than 125 ppm oil concentration and the response time is less than 10 seconds. Recommendations for a field prototype instrument are presented.

[from Government Reports Announcements 76(13):#AD-A023 839/4GA. 1976]

C-1786-76

OIL LEVEL DETECTION CIRCUIT

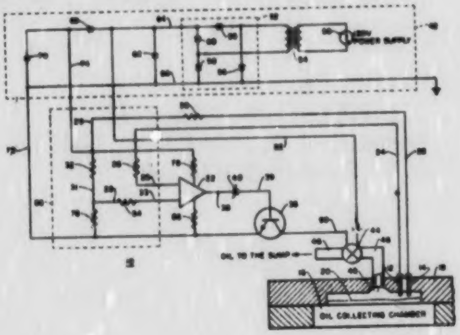
Huang, K. 1976.
U.S. Patent 3,958,157

Monitoring, Detection, *Oil-on-water, *Oil-collecting chamber

A method is described for detecting the level of oil in an oil-collecting chamber containing oil floating on water. The device is a sensing circuit with two electrodes and an amplifier allowing the presence of oil and the thickness of oil in the chamber to be monitored.

[from Petroleum Abstracts 16(36):#224,527. 1976]

3,958,157
OIL LEVEL DETECTION CIRCUIT
Kwang-ta Huang, Oxnard, Calif., assignor to The United States of America as represented by the Secretary of the Navy, Washington, D.C.
Filed Feb. 12, 1975, Ser. No. 549,396
Int. Cl.^{2} G05D 9/12
U.S. Cl. 317—123 **7 Claims**



C-1787-76
MONITORING ESTUARINE CIRCULATION AND OCEAN WASTE DISPERSION USING AN INTEGRATED SATELLITE-AIRCRAFT-DROGUE APPROACH
Klemas, V., G. Davis, H. Wang, W. Whelan, and G. Tornatore. 1975.
International Conference on Environmental Sensing and Assessment, Las Vegas, 1975. New York, Institute of Electrical and Electronics Engineers, Inc., 1976. Vol. 1. p.1 16-2 to 10 16-2.

Remote sensing, Oil slicks, Movement

An integrated satellite-aircraft-drogue approach has been developed which provides a cost-effective, synoptic means for studying ocean current circulation, monitoring oil slick movements, and tracing waste dispersion in coastal areas and on the Continental Shelf.

[from International Aerospace Abstracts 16(11):#25926. 1976]

C-1788-76
THE OCCURRENCE OF ORGANIC MICROPOLLUTANTS IN THE RIVER RHINE AND THE RIVER MAAS IN 1974
Meijers, A.P., and R. Chr. Van der leer. 1976.
Water Research 10(7):597-605.

Rhine River, Contamination, *Maas River, Europe

The results of investigations of the organic pollution of the river Rhine and river Maas during 1974 are summarized in this article. Analyses show that the river Rhine is heavily polluted by oil, a number of aromatics and aromatic bases, and a number of oxygenated substances. The river Maas is much less polluted by these substances with the exception of oil.

C-1789-76
OIL-IN-WATER CONTENT MONITOR DEVELOPMENT PROGRAM SUMMARY
Montfort,R.W. 1975.
Interim report, USCG-D-188-75. 42p.

Wastewaters, Design and engineering, Oil-water separation

Three concepts for oil-in-water content monitors developed under separate Coast Guard contracts are described. These monitors were modified to improve their sensitivity and selectivity to oil and to demonstrate their capabilities and limitations in monitoring the effluent from an oily water separator.

[from Government Reports Announcements 76(11):#AD-A022960/9GA. 1976]

C-1790-76
OIL POLLUTION TOTALIZER
Moreau, J.D., and R.A. Halko. 1975.
U.S. Patent 3,924,449

Oil discharges, Wastewaters, Sampling

The totalizer provides for the removal of oil from a sample stream, control of the sample flow rate in proportion to the stream flow rate, and storage of the oil for analysis by a continuous oil monitoring device or by standard laboratory techniques.

[from Selected Water Resources 9(10):#W76-04603. 1976]

3,924,449

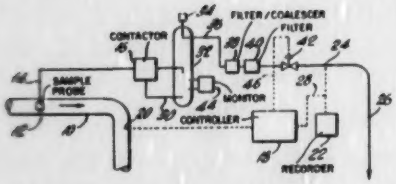
OIL POLLUTION TOTALIZER

James O. Moreau, Morris Plains, and Richard A. Halko, Flanders, both of N.J., assignors to Exxon Research and Engineering Co., Linden, N.J.

Disclosure was also published under Trial Voluntary Protest Program on Jan. 28, 1975.

Int. Cl.^{2} G01F *1/00*; **G01N** *1/20*

U.S. Cl. 73—61.1 R **8 Claims**



C-1791-76
OIL DETECTOR
Ohtsu, T., Y. Nakamura, and A. Sugimoto. 1976.
German Offenlegungsschriften (unexamined patent application) 2,528,026

Detection, Design and engineering, *Oil detector

"Oil is detected in water using a cell that is an arm of a wheatstone bridge. Inside the cell is a layer of conductive graphite covered by a water repellant filter made of Polyflon, polyethylene, or silicon impregnated paper."

[from Chemical Abstracts 84(26):#184652c. 1976]

C-1792-76
METHOD AND MEANS FOR MONITORING THE QUANTITY OF DISPERSED OIL IN WATER
Rosso, F. B., and H. Ross. 1974.
Canadian Patent 960,060

Wastewaters, Dispersions, Design and engineering

This system includes an ultraviolet light source for transmission of light through the sample of oily water, a chamber to contain the sample, a photocell to translate the transmitted ultraviolet light into an electrical signal, circuit and registration means, and a reciprocating wiper to clean the interior of the sample chamber.

[from Selected Water Resources Abstracts 9(11):#W76-05338. 1976]

C-1793-76
DETECTION AND RECORDING OF OIL IN MIXTURES OF OIL AND WATER
Underwood, H., and W.A. Radford. 1976.
British Patent 1,429,470

Detection, Contamination

Presence of oil in water is detected and recorded by bringing the water in contact with a tape that is connected to an oil sensing device. The specially treated tape, which has both on oleophilic and hydrophobic surface, can be stored to provide a record of the oil present in the water.

[from Petroleum Abstracts 16(25):#220,841. 1976]

C-1794-76
BASELINE INFORMATION ON CHEMICAL OCEANOGRAPHY AND PETROLEUM-BASED HYDROCARBONS IN THE SOUTHERN BEAUFORT SEA
Wong, C.S., W.J. Cretney, R.W. MacDonald, and P. Erickson. 1974.
Interim report of the Beaufort Sea Project Study C3. 51p.

Hydrocarbons, Tar, Beaufort Sea, Sampling

Chemical oceanographic studies conducted in the Beaufort Sea drilling area during summer, 1976, indicate that the marine environment in these waters is very clean. No tar or plastic wastes were found in the samples. The levels of dissolved polyaromatic hydrocarbons and gaseous hydrocarbons were found to be low, approaching those of uncontaminated Pacific Ocean waters.

C-1795-76
TAR AND PARTICULATE POLLUTANTS ON THE BEAUFORT SEA COAST
Wong, C.S., D. MacDonald, and W.J. Cretney. 1976.
Beaufort Sea Project, Technical report no. 13. 96p.

Tar, Natural seepage, Hydrocarbons, Chemical analysis, Beaufort Sea, *Distribution

The report describes the methods and results of a study designed to establish the baseline distribution of particulate pollutants, especially for tar and plastics, in the present-day Beaufort Sea marine environment; to establish areas with natural seepage of crude oil; and to determine the chemical characteristics of hydrocarbons in beach sediment, nearshore sediment, and marine organisms. Results indicated that the coastline along the Beaufort Sea studied in the summers of 1974 and 1975 is very clean with respect to oil and tar accumulation; however, plastics contamination of beach areas was prevalent. No natural seepage of crude oil was found in areas surveyed.

Information: C.S. Wong, Department of the Environment, Ocean & Aquatic Sciences, Pacific Region, Ocean Chemistry Division, 211 Harbour Rd., Victoria, B.C. V9A 352 Canada

C-1796-76
INVERTED SIPHONS FOR OIL TRAPPING
Ziegler, R.C., R.E. Baier, and D.J. Schuring. 1976.
Final report, EPA/600/2-76/028. 66p.

Waste oil, Chemical analysis, Pollution prevention, New York, *Buffalo River

Investigations of the oil trapping characteristics of inverted siphons for preventing and eliminating oil pollution in the Buffalo River are described. A detailed spectroscopic and chromatographic analysis of water samples revealed that most of the trapped oil was of petroleum origin and was traced to fuel oil spills. Inverted siphons were demonstrated to be nearly 100% effective for trapping surface oils, but trapping efficiency is very low for emulsified oil carried in bulk water.

[from Government Reports Announcements 76(8):#PB-249 360/9GA. 1976]

3. REMOTE SENSING

C-1797-76
TAMU SCIENTISTS DEVELOP AUTOMATIC POLLUTION DETECTOR (news brief)
Anon. 1976.
Sea Technology 17(7):38.

Detection, Oil spills, Design and engineering, U.S. Coast Guard

A twin laser device which can be used to detect oil pollution automatically has been developed by Texas A & M University. Capable of scanning an area for one complete year without maintenance in all kinds of weather, it will provide an alarm to Coast Guard cleanup stations. This device will be the only in situ oil spill sensor in existence, since it is designed to be mounted on bridges to monitor river and harbor waters continuously.

C-1798-76
EXPERIENCES WITH REMOTE SENSING TECHNIQUES FOR QUESTIONS REGARDING COASTAL WATERS [in German]
Bähr, H.P. 1975.
Symposium on Earth Surveys, Porz-Wahn, West Germany, 1975. Cologne, Deutsche Forschungs und Versuchsanstalt für Luft-und Raumfahrt, 1975. p. 481-487.

Oil spills, Spreading, Germany, West

Remote sensing techniques for studying water pollution phenomena along the German North Sea coast are described including certain photogrammetric techniques which proved useful in the analysis of a spreading oil slick.

[from International Aerospace Abstracts 16(14):#31459. 1976]

C-1799-76
ENVIRONMENTAL ASSESSMENT OF RESOURCE DEVELOPMENT IN THE ALASKAN COASTAL ZONE BASED ON LANDSAT IMAGERY
Belon, A.E., J.M. Miller, and W.J. Stringer. 1975.
NASA Earth Resources Surv. Symposium. Vol. 2B:242-260.

Oil spills, Movement, Environmental effects, Offshore development, Alaska coast

Landsat data has been shown to be effective for developing models of suspended transport and for preparing contingency plans based on the movement of oil spills in Alaskan coastal waters. Physical and biological impacts of developmental activities on the coastal zone may also be assessed using Landsat imagery.

[from Petroleum Abstracts 16(35):#224,214. 1976]

C-1880-76
THE INVESTIGATION OF THE INFLUENCE OF SEA ROUGHNESS ON THE REMOTE SENSING OF OIL POLLUTION BY THE ACTIVE METHOD [English summary]
Bogorodsky, V.V., M.A. Kropotkin, and T. Yu Sheveleva. 1975.
Okeanologiya 15(6):1112-1115.

Baltic Sea, *Oil pollution

"Investigations were carried out during the expedition in the Baltic Sea at the wind speed between 3 m/sec and 15 m/sec with the help of a special electrical model. Dynamic time constant and contrast in the reflectance properties of oil pollution and pure water vs wind speed were obtained."

C-1801-76
AIRBORNE LASER REMOTE SENSING SYSTEM FOR THE DETECTION AND IDENTIFICATION OF OIL SPILLS
Fantasia, J.F., and H.C. Ingrao. 1975.
U.S. Patent 3,889,213

Detection, Source identification, Oil spills, *Fluorescence

This system directs pulses of high energy artificial light onto the spill to cause the oil to fluoresce. Since each oil has a distinct fluorescent spectral signature, detection and identification of an oil spill is very accurate.

[from Government Reports Announcements 76(11):#Patent-3,889,213. 1976]

C-1802-76
OILSPILL SURVEILLANCE, DETECTION, AND EVALUATION BY REMOTE SENSING
Jones, D.R. 1975.
NASA Earth Resources Surv. Symposium. Vol. 2B:271-279.

Oil spills, Detection, Monitoring, Regulations

The U.S. Environmental Protection Agency (EPA) and the U.S. Coast Guard are currently using aerial and fixed platform oil spill detection systems primarily based on remote sensing devices. The incidence of oil spills is expected to decrease with maximum surveillane in 1978. Federal regulations and industrial monitoring are also discussed.

[from Petroleum Abstracts 16(35):#224,216. 1976]

C-1803-76
AERIAL REMOTE SENSING APPLICATIONS IN SUPPORT OF OIL SPILL CLEANUP, CONTROL AND PREVENTION
Jones, D., R. Landers, and A. Pressman. 1975.
International Conference on Environmental Sensing and Assessment, Las Vegas, 1975. New York, Institute of Electrical and Electronics Engineers, Inc., 1976. Vol. 1. p.1 17-5 to 4 17-5.

Oil spills, Pollution prevention, Cleanup, *U.S. Coast Guard

The aerial remote-sensing surveillance systems used by the U.S. Coast Guard and the Environmental Protection Agency for detecting oil discharges and supporting oil spill cleanup and control operations are described. The functions of the Coast Guard's Airborne Oil Surveillance System are summarized, and examples of actual and hypothetical oil spill scenarios and responses to them are presented.

[from International Aerospace Abstracts 16(11):#25933. 1976]

C-1804-76
THE INFLUENCE OF COASTAL FRONTS ON THE MOVEMENT AND DISPERSION OF OIL SLICKS
Klemas, V., G. Davis, and S. Kupferman. 1976.
Report NASA-CR-146334, Contract NAS5-20983. 3p.

Oil slicks, Movement, Coasts, Estuaries, Delaware Bay, *LANDSAT

Oil slick tracking experiments were conducted in Delaware Bay to verify a predictive oil dispersion and movement model. LANDSAT satellites and aircraft tracking data were used to support the conclusion that during certain parts of the tidal cycle the oil slicks tend to line up along coastal and estuarine salinity gradients or fronts.

[from Government Reports Announcements 76(11):#E76-10223. 1976]

C-1805-76
VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL
Klemas, V., G. Davis, and H. Wang. 1976.
Report NASA-CR-146336, Contract NAS5-20983. 3p.

Oil slicks, Movement, Delaware Bay, *LANDSAT

Oil slick movement was tracked on four different dates in Delaware Bay using LANDSAT, aircraft, ships, and air-dropped drogues. A predictive model for oil slick movement was verified using data on size and location of slick, current and wind velocities, and the nature of the oil. Convergent coastal fronts were found to significantly influence the movement and dispersion of oil slicks.

[from Government Reports Announcements 76(11):#E76-10225. 1976]

C-1806-76
FLIGHT EVALUATION OF U.S. COAST GUARD AIRBORNE OIL SURVEILLANCE SYSTEM
Maurer, A., and A.T. Edgerton. 1976.
Marine Technology Society Journal 10(4):38-52.

Detection, Oil spills, Natural seepage, California coast

A prototype airborne oil surveillance system was tested off the California coast by the U.S. Coast Guard. Data were obtained from routine shipping, controlled oil spills, and natural seeps. The system detected and mapped oil spills and seeps in conditions ranging from cloudy to clear, from wind speeds of 0-46 km/hr (0-25 knots) and from daytime to night. In all cases the discharges were detected and mapped at ranges up to 22 kilometers.

C-1807-76
APPLICATIONS OF REMOTE SENSING TO ESTUARINE PROBLEMS
Munday, J.C. Jr. 1975.
Annual report, NASA-CR-146075, AR-3. 178p.

Estuaries, Shorelines, Ecosystems, *Oil pollution

Summary not available.

[from Government Reports Announcements 76(10):#N76-15526/6GA. 1976]

C-1808-76
REMOTE SENSING AND ANALYSIS OF OCEANOGRAPHIC PARAMETERS FROM ERTS-1
Needham, B.H. 1975.
Ocean 75, Combined Meeting of IEEE Conference on Engineering in the Ocean Environment and Annual Meeting of the Marine Technology Society, 11th, San Diego, 1975. IEEE--75-CHO-995-1-OEC. p. 798-802.

Oil spills, Natural seepage, Monitoring, *ERTS-1

Remote sensing data collected by the Earth Resources Technology Satellite (ERTS-1) have provided repetitive coverage of oceanographic parameters, such as detection and monitoring of oil spills, seeps, and sludge dump sites.

[from Aquatic Sciences and Fisheries Abstracts 6(6):#6Q5802. 1976]

C-1809-76
THE USE OF TELEVISION FOR REMOTE SENSING
Worsfold, R.D., J.A. Allen, and B.E. Fretts. 1975.
Remote Sensing of the Environment 4(1):5-35.

Oil slicks, Oil spills, Monitoring, St. Lawrence River, Bahamas

Experimental oil spills were produced in daytime and at night in the St. Lawrence Seaway and off Grand Bahama Island. The formation and dispersion of the resultant oil slicks were monitored with closed circuit TV and low-light level TV camera systems. These tests clearly indicated that television is a very useful sensor system which should be an integral part of any oil spill monitoring program.

4. SAMPLING

C-1810-76
No title given (news brief)
Anon. 1976.
Chemical and Engineering News 54(25):20.

Oil spills, Adsorption

The Naval Research Laboratory has developed two inexpensive techniques for sampling and measuring the thickness of oil spill films on water. One method uses a 5-mil hydrophilic Teflon sheet which adsorbs the oil. Polyurethane foam disks are used in a second method by which oil can be adsorbed. These oleophilic and hydrophobic disks can be weighed before and after contact with the oil to determine oil film thickness.

C-1811-76
SAMPLING AND IDENTIFICATION OF POLLUTANT OILS IN INDUSTRIAL WATERCOURSES
Baier, R.E., E.A. Gasiecki, R.P. Leonard, and E.J. Mack. 1976.
Final report, EPA/600/2-76/031. 255p.

Source identification, Analytical techniques, Oil spills, Industries, Cleanup

A documented discussion of methods for sampling and identifying pollutant oils in industrial watercourses is given. Gas chromatography and infrared spectroscopy along with other analytical techniques for oil pollution analysis are presented. Various oil spill cleanup and recovery systems are evaluated.

[from Government Reports Announcements 76(8):#PB-249-362/56A. 1976]

C-1812-76
DISTRIBUTION OF OIL AGGREGATES IN THE SURFACE LAYER OF THE MEDITERRANEAN SEA IN APRIL - JUNE 1974 [English summary]
Benzhitskij, A.G., and G.G. Polikarpov. 1976.
Okeanologiya 16(1):87-91.

Monitoring, Mediterranean Sea, *Oil aggregates, *Distribution

The central and western areas of the Mediterranean Sea were sampled with a neuston net in order to determine the quantitative distribution of petroleum aggregates. Maximum pollution was found in the coastal areas of the Ionian, Tyrrhenian and Ligurian Seas (6.23, 5.78, and 4.33 mg/m^2, respectively). Minimal pollution was observed in the Black and Aegean Seas. Some sizes of aggregates were covered with periphyton.

C-1813-76
OIL AND GAS SEEPS IN ALASKA. ALASKA PENINSULA, WESTERN GULF OF ALASKA
Blasko, D.P. 1976.
Bureau of Mines, RI-8122. 85p.

Natural seepage, Alaska, *Alaska Peninsula

Oil and gas seeps of the Iniskin Peninsula and Becharof Lake regions of the Alaskan Peninsula were investigated in an attempt to determine whether the seeps are still active. Oil, water, gas, and oil-water samples were taken and analyzed; the results are discussed.

[from Government Reports Announcements 76(16):#PB-253013/7GA. 1976]

C-1814-76
SAMPLING AND ANALYTICAL STRATEGIES FOR COMPOUNDS IN PETROLEUM REFINERY STREAMS. VOLUME I
Bombaugh, K.J., E.C. Cavanaugh, J.C. Dickerman, S.L. Keil, and T.P. Nelson. 1976.
Final report, EPA/600/2-76/012a, Contract EPA-68-02-1882. 140p.

Chemical analysis, Wastewaters, Refineries

A general sampling and analytical strategy developed for use in the identification of potentially hazardous components in process and waste streams is described. Sampling, separation, and measurement, with options for different stream types, are included. The strategy was applied to five petroleum refinery streams including various emissions and effluent water from an API separator.

[from Government Reports Announcements 76(13):#PB-251 744/9GA. 1976]

C-1815-76
SAMPLING AND ANALYTICAL STRATEGIES FOR COMPOUNDS IN PETROLEUM REFINERY STREAMS. VOLUME II. PROCESS ANALYSIS OF PETROLEUM REFINERY STREAMS
Bombaugh, K.J., E.C. Cavanaugh, J.C. Dickerman, S.L. Keil, and T.P. Nelson. 1976.
Final report, EPA/600/2-76/012b, Contract EPA-68-02-1882. 196p.

Chemical analysis, Wastewaters, Refineries

An actual test study to determine from available literature and through engineering analysis the potentially hazardous components in five effluents from a refinery is described. Study results are then to be applied to the development of a sampling and analysis strategy for hazardous components in these streams. The five streams studied include various emissions and effluent from an API separator.

[from Government Reports Announcements 76(13):#PB-251 754/6GA. 1976]

C-1816-76
DISTRIBUTION OF TAR GLOBULES AND THEIR SESSILE ORGANISMS
Kajihara, T., and Y. Ura. 1974.
Preliminary report of the Hakuho Maru Cruise KH-73-5, November 21 - December 18, 1973, Western North Pacific adjacent to Ryukyu and Taiwan Islands. S. Tanaka (ed.). Japan, Ocean Research Institute, University of Tokyo, 1974. p. 49-50.

Tar, Marine organisms, Pacific Ocean

Tar globules visible to the naked eye were collected in order to classify their horizontal distribution and relationship to sessile organisms attached to them. Bryozoans, barnacles, serpulids and blue-green algae were the dominant organisms found.

[from Aquatic Sciences and Fisheries Abstracts 6(5):#6Q5457. 1976]

C-1817-76
PELAGIC TAR IN THE MEDITERRANEAN SEA, 1974-75
Morris, B.F., et al. 1975.
Environmental Conservation 2(4):275-281.

Tar, Mediterranean Sea, Monitoring

Samples of pelagic tar taken from several stations in the Mediterranean Sea from 12/74 to 1/75 were compared with those taken during a similar survey in 1969. Total standing stock of pelagic tar in the Mediterranean is lower at present than in 1969 due to the decrease in pollution of the eastern basin. Changes in amount of tar should continue to be monitored with the reopening of the Suez Canal.

[from Environment Abstracts 6(6):#76-04305. 1976]

C-1818-76
STUDY ON THE HEAVY OIL CONTAMINATION IN THE NORTHWEST COAST OF BAJA CALIFORNIA [English summary]
Perez Higuera, R., and S. Alvarez Borrego.
Ciencia Marina 1(2):63-74.

Contamination, Beaches, Baja California, Fuels

Periodic sampling and meter deep cores were taken in the beaches of northwestern Baja California to determine the extent of oil pollution. The results obtained indicate a greater concentration in the area where PEMEX unloads its fuels.

[from Aquatic Sciences and Fisheries Abstracts 6(5):#6Q5461. 1976]

C-1819-76
PELAGIC TAR IN THE CARIBBEAN AND EQUATORIAL ATLANTIC, 1974
Sleeter, T.D., B.F. Morris, and J.N. Butler. 1976.
Deep-Sea Research 23(5):467-474.

Tar, Caribbean Sea, Atlantic Ocean

Pelagic tar was sampled at 61 stations in the Caribbean and 31 stations in the eastern north and equatorial Atlantic. Tar densities in the Caribbean and Canary Current region were similar to previously recorded densities; but in the equatorial Atlantic densities were significantly lower than others have found. Data suggest that although the Caribbean has a lower standing stock of tar than the Sargasso Sea, comparable quantities of tar probably pass through the former in unit time.

C-1820-76
THE PRESENCE OF POLLUTANT HYDROCARBONS IN ESTUARINE EPIPELIC DIATOM POPULATIONS
Thompson, S., and Eglinton. 1976.
Estuarine and Coastal Marine Science 4(4):417-425.

Hydrocarbons, PAH, Estuaries, England, *Epipelic diatoms

A complex mixture of aliphatic hydrocarbons detected in the organic extracts of three populations of Severn Estuary epipelic diatoms are shown to be similar to the characteristic crude oil-type aliphatic hydrocarbon distribution found in the estuary's sediments. Crude oil-type polynuclear aromatic hydrocarbons (PAH) found in the sediment were absent in the diatoms. Possible routes of selective incorporation of hydrocarbons in these organisms and the environmental significance of this process are discussed.

5. ANALYSIS

C-1821-76

FACTORS AFFECTING THE EXTRACTION AND ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER

Acheson, M.A., R.M. Harrison, R. Perry, and R.A. Wellings. 1976.
Water Research 10(3):207-212.

Chemical analysis, Chromatography, PAH, Sampling

Factors affecting the efficiency of extraction of polynuclear aromatic hydrocarbons (PAH) from water samples are: the initial concentration of PAH, the presence of suspended solids, and prolonged storage of the sample prior to analysis. Analyses were performed using thin-layer and gas-liquid chromatography.

[from The Engineering Index Monthly 14(6):#042679. 1976]

C-1822-76

MEASUREMENT OF HYDROCARBONS IN WATER AND SEDIMENT

Brown, R.A. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 133a-151.

Analytical techniques, Hydrocarbons, Seawater, Sediment

The paper describes methods of hydrocarbon determination in sediment and water. Techniques cover sample collection, storage, and the measurement of hydrocarbons as individual compounds or as a total. It is stated that more than one procedure is required to measure the complete range of crude oil hydrocarbons and the concentrations encountered in a given sample.

[from Selected Water Resources Abstracts 9(11):#W76-05144. 1976]

C-1823-76

SAMPLING AND ANALYSIS OF NONVOLATILE HYDROCARBONS IN OCEAN WATER

Brown, R.A., J.J. Elliott, J.M. Kelliher, and T.D. Searl. 1976.
Analytical Methods in Oceanography. R.P. Gibb (ed.). Washington, D.C., American Chemical Society, 1975. p. 172-187. (Advances in Chemistry Series 147. 238p.)

Hydrocarbons, Oceans, Chemical analysis, Chromatography, Spectrometry, Sampling

Hydrocarbons heavier than C_{13} are extracted with CCl_4. Sample volume is first reduced by evaporation and addition of n-pentane; then the sample is passed through a silica gel column. The fractions are subjected to infrared and ultraviolet spectrophotometry, gas chromatography and mass spectrometry for detailed characterization.

C-1824-76
METHODS FOR POLYNUCLEAR AROMATIC [sic]
Brown, R.H. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 151a-157.

Analytical techniques, Detection, PAH, Chromatography, Spectrometry

Methods to identify and measure polynuclear aromatic hydrocarbons (PNA) in petroleum products such as gasoline and used crankcase oil are reviewed. The most effective procedure, combining gas chromatography and ultraviolet absorption spectrophotometry, is detailed.

[from Selected Water Resources Abstracts 9(11):#W76-05145. 1976]

C-1825-76
A SCREENING BIOASSAY USING *DAPHNIA PULEX* FOR REFINERY WASTES DISCHARGED INTO FRESHWATER
Buikema, A.L., D.R. Lee, and J. Cairns, Jr. 1976.
ASTM Journal of Testing and Evaluation 4(2):120-125.

Toxicity, Wastewaters, Refineries, **Daphnia pulex*

A simple bioassay method is suggested for on-site toxicity testing of refinery effluents. *Daphnia pulex* was selected among the array of invertebrates and fish evaluated because it was the most sensitive, relatively inexpensive and easy to maintain, and a potential fish-food organism. In tests of the bioassay method conducted at six petroleum refineries, data show that the method was reproducible and personnel were able to perform the bioassay.

C-1826-76
STUDIES OF OILS AND POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE-RELATED SYSTEMS
Caddy, D.E., and D.M. Meek. 1976.
Proceedings of Analytical Division of Chemical Society 13(2):45-47.

Chemical analysis, PAH, Wastewaters, Chromatography, *Fluorimetry

A technique is described for extracting mineral oils from aqueous samples, isolating polar materials, and then determining the polycyclic aromatic hydrocarbons present by a combination of gas chromatography for separation and fluorimetry for detection.

[from WRC Information 3(12):#76-908S. 1976]

C-1827-76
STUDIES ON THE OFFENSIVE-ODOR FISH OF THE NAGARA RIVER. V. IDENTIFICATION OF OFFENSIVE ODOR SUBSTANCES BY HIGH-RESOLUTION GAS CHROMATOGRAPHY-MASS SPECTROMETRY [English summary]
Funasaka, R., K. Tanaka, Y. Itagaki, Y. Ose, and T. Sato. 1975.
Eisei Kagaku 21(6):341-347.

Chemical analysis, Chromatography, Spectrometry, Hydrocarbons, Fishes

High-resolution gas chromatography-mass spectrometry was used to analyze the CH_2Cl_2 extracts of fish meat. Among the offensive-odor causing substances detected were aromatic hydrocarbons, phenol, and aliphatic hydrocarbons.

[from Chemical Abstracts 85(1):#2757f. 1976]

C-1828-76
THE ECOLOGICAL, CHEMICAL AND HISTOPATHOLOGICAL EVALUATION OF AN OIL SPILL SITE. PART II. CHEMICAL STUDIES.
Gambardella, R.A., L.C. Jiang, J. Quan, D.W. Majo, C.G. Cogger, and D. Donovan. 1975.
Marine Pollution Bulletin 6(11):166-171.

Oil spills, Chemical analysis, Chromatography, Sediments, Maine, *Long Cove oil spill

The Long Cove oil spill in Maine was identified to be No. 2 fuel oil mixed with JP5 jet fuel. Gas chromatography was used to analyze sediment samples; significant quantities of petroleum hydrocarbons were found.

[from Aquatic Sciences and Fisheries Abstracts 6(5):#6Q5473. 1976]

C-1829-76
METHODS FOR STUDYING THE EFFECTS OF MARINE OIL SPILLS
Grassle, J.F. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973.
Washington, D.C., National Academy of Sciences. Vol. 1. p. 322a-346a.

Analytical techniques, Oil spills, Biological effects, Sampling

An analysis of methods used in several biological studies to measure the effects of oil spills has resulted in a list of procedural recommendations to make such studies more complete and representative. The specific recommendations deal with quantitative and qualitative aspects of chemical, biological and sedimentological sampling procedures.

[from Selected Water Resources Abstracts 9(11):#W76-05152. 1976]

C-1830-76
ANALYSIS OF WATER EXTRACTS OF CRUDE PETROLEUM BY GEL PERMEATION CHROMATOGRAPHY
Larson, R.A., and J.C. Weston. 1976.
Bulletin of Environmental Contamination and Toxicology 16(1):44-52.

Chemical analysis, Chromatography, Hydrocarbons, Crude oil

A new procedure using gel permeation chromatographic analysis was used for the rapid analysis of water soluble petroleum fractions. The effectiveness of this method in characterizing aromatic and aliphatic hydrocarbons, fluorescent compounds, and phenolic substances present in four different crude oils is discussed.

C-1831-76
THE QUANTITATIVE DETERMINATION OF TRACE CONCENTRATIONS OF PETROLEUM-DERIVED POLLUTANTS IN THE OCEAN
Levy, E.M. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973.
Washington, D.C., National Academy of Sciences. Vol. 1. p. 192-223.

Analytical techniques, Sampling, Contaminants, Oceans

Techniques for sampling and extraction were outlined. The advantages and limitations of gravimetric procedures, ultraviolet absorption, ultraviolet fluorescence, IR absorption spectrophotometry, and elemental analyses and gas chromatography for the quantification of low levels of petroleum pollutants present in the open ocean were discussed in detail.

[from Selected Water Resources Abstracts 9(11):#W76-05147. 1976]

C-1832-76
DETERMINATION OF POLYAROMATIC AND OTHER HYDROCARBONS IN WATER BY MEANS OF GAS - AND HIGH PRESSURE LIQUID CHROMATOGRAPHY
Markl, P., H. Aichinger, and J.F.K. Huber. 1976.
Annual Symposium on Recent Advances in the Analytical Chemistry of Pollutants, 6th, Vienna, 1976. Abstract.

Detection, Hydrocarbons, PAH, Chemical analysis, Chromatography, Carcinogens

Although gas chromatography is effective in detecting many pollutant hydrocarbons in water, polyaromatic and other hydrocarbons of low solubility must be detected by other methods, such as high pressure liquid chromatography used in conjunction with UV-absorption or fluorescence detection. Use of this technique for determining the presence of low-level concentrations of carcinogenic polycyclic hydrocarbons is described.

C-1833-76
POLYNUCLEAR AROMATIC HYDROCARBONS IN THE ENVIRONMENT. I. DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER BY MASS FRAGMENTOGRAPHY [English summary]
Matsushima, H., and T. Hanya. 1975.
Bunseki Kagaku 24(8):505-511.

PAH, Chemical analysis, Chromatography, Carcinogens, *Fragmentography

Carcinogenic hydrocarbons in the Tama River were determined after filtering the water. The chemical extraction techniques and the methods for separating and analyzing the hydrocarbons by chromatography and mass fragmentography are detailed. The water was found to contain fluoranthene pyrene, 3,4-benzpyrene, and 1,12-benzpyrene in quantities exceeding 100 parts per trillion.

[from Chemical Abstracts 84(24):#169452u. 1976]

C-1834-76
ANALYTICAL STUDIES OF SOME AREAS ALONG THE CALABRIA COAST
Mazzei, L. 1975.
Inquinamento 17(7-8):13-17.

Sampling, Chemical analysis, Coasts, Italy, Oil discharges, Tankers

Surveys were conducted in 1971, 1972 and 1974 along a 190 km area of the Ionian and Tyrrhenian coasts of Calabria, and measurements were made of dissolved O_2, BOD_5, NH_3, NO_2, phosphate, surfactants and oil (by ether extraction). As indicated by relatively large amounts of ether extractables in some samples, oil tank washings from ships in transit were found to be a major source of pollutants.

[from Chemical Abstracts 84(24):#169388c. 1976]

C-1835-76
THIN-LAYER CHROMATOGRAPHIC ANALYSIS IN WASTE CHEMISTRY
McGonicle, E.J. 1975.
Chromatographic Analysis of the Environment. R.L. Grob (ed.).
New York, Dekker, 1975. p. 639-673.

Chemical analysis, Hydrocarbons, Wastewaters, Waste oils, Chromatography, Bibliographies

The detection of numerous contaminants in wastewaters, such as hydrocarbons, oils and greases, phenolic compounds and fuels by thin layer chromatography is reviewed. An extensive bibliography is included.

[from Chemical Abstracts 85(2):#9872y. 1976]

C-1836-76
HYDROCARBON RESIDUES IN SEDIMENTS OF THE CONTINENTAL SHELF OF THE LANGUEDOC IN THE MEDITERRANEAN
Mestres, R., C. Causse, Ch. Duboul Razavet, and F. Gadel. 1975.
Travaux de la Societe de Pharmacie de Montpellier 35(2):137-141.

Hydrocarbons, Sediments, Mediterranean Sea, Analytical techniques, Spectrometry

Infrared spectrophotometry was used to measure the hydrocarbon content of sediments sampled on the continental shelf between Sete and Fos sur Mer in the Mediterranean Sea. Results are presented and details are given on the method of extraction and analysis.

[from Environmental Health and Pollution Control 9(4):#972. 1976]

C-1837-76
OIL POLLUTION RESEARCH PROGRAM
Prouse, N.J. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 75-77.

Analytical techniques, Hydrocarbons, Seawater, Canada, Biological effects, Marine organisms

This program was initially aimed at improving existing and developing new analytical procedures for determining hydrocarbons in seawater. These methods were used on surveys to find the extent of dissolved and suspended hydrocarbon pollution in waters off of eastern Canada. The effects of various oils on marine phytoplankton photosynthesis and on certain intertidal organisms are being investigated. Future plans will attempt to develop oil budgets for Nova Scotian inlets.

[from Petroleum Abstracts 16(28):#221,990. 1976]

C-1838-76
FLUORESCENCE MEASUREMENTS OF CARCINOGENIC AND POLYCYCLIC AROMATIC HYDROCARBONS IN WATER
Schwarz, F.P., and S.P. Wasik. 1976.
International Conference on Environmental Sensing and Assessment 2(30-2):1-5.

Chemical analysis, PAH, Aromatic hydrocarbons, Carcinogens, *Fluorescence

Polycyclic aromatic hydrocarbons (PAH) in aqueous solutions were measured and identified using spectrofluorimetry. Sodium chloride at seawater concentrations and mg/l concentrations of iron, zinc, cobalt, and nickel cations in the water do not affect PAH fluorescence intensity.

[from Government Reports Announcements 76(16):#PB-252 734/9GA. 1976]

C-1839-76
1970 ARROW BUNKER C IN 1974: RE-ENTRY OF STRANDED BUNKER C OIL FROM A LOW-ENERGY BEACH INTO THE MARINE ENVIRONMENT
Vandermeulen, J.H. 1975.
Pacific Science Congress, 13th, 1975. Vancouver, University of British Columbia, 1975. Vol. 1. p. 85-56. Abstract.

Analytical techniques, Spectroscopy, Fuel oil, Hydrocarbons, Marine organisms, Sediments

Fluorescence spectroscopy was used to analyze tidal and beach interstitial water, selected marine invertebrates, and algae. The main route of tidal removal of stranded oil deposits in a low energy beach appears to be via the sediments, where residence time is long. Burrowing and rooted organisms are subjected to high levels of petroleum hydrocarbons.

[from Oceanic Abstracts 13(4):#76-03570. 1976]

C-1840-76
SATURATED HYDROCARBON MATERIAL IN SEDIMENTS OF THE DELAWARE ESTUARY AS DETERMINED BY GAS CHROMATOGRAPHIC ANALYSES
Wehmiller, J.F., and M. Lethan. 1975.
University of Delaware, Final report, CMS-RANN-3-75. 87p.

Chemical analysis, Chromatography, Hydrocarbons, Sediments, Delaware Bay, Oil spills, Sampling

This report presents a preliminary interpretation of the analyses of hydrocarbon material in sediments of the Delaware estuary as determined by solvent extraction, column chromatography, and gas-liquid chromatography. Thirty-five stations from Philadelphia to the bay mouth have been analyzed. Several stations have been reoccupied and reanalyzed following the oil spill from the "Corinthos" tanker explosion on January 31, 1975; many of these "post-Corinthos" samples are discussed in the appendix to the report.

C-1841-76
STUDIES ON THE LIPIDS OF COASTAL WATERS. II. HYDROCARBONS OF SEDIMENTS IN HIUCHI NADA
Yamada, H., and M. Kayama. 1975.
Hiroshima Daigaku. Sui-Chikusangakubu, Fukuyama, Japan. Hiroshima Daigaku Sui-Chikusangakubu Kiyo 14(1):37-47.

Hydrocarbons, Sediments, Chemical analysis, Chromatography, Japan

Sediments were analyzed for their hydrocarbon content using gas-liquid chromatography. Test results indicate that biogenic hydrocarbons are decomposing faster than nonbiogenic hydrocarbons which suggests that the hydrocarbons are mainly derived from the organisms in the Seto Inland Sea.

[from Oceanic Abstracts 13(4):#76-03500. 1976]

C-1842-76

DETERMINATION OF POLYCYCLIC HYDROCARBONS BY CHANNEL THIN-LAYER CHROMATOGRAPHY

Zoccolillo, L., and A. Liberti. 1976.
Journal of Chromatography 120(2):485-488.

Detection, PAH, Chemical analysis, Chromatography

A rapid and reliable thin-layer chromatography technique is described for the quantitative determination of polycyclic aromatic hydrocarbons (PAH). The procedure was used to analyze the total PAH content of gasoline exhaust, atmospheric dust, and lubricating oil and would be applicable in petroleum pollution studies.

6. SOURCE IDENTIFICATION

C-1843-76
EUROPEAN EXPERIENCE IN THE IDENTIFICATION OF WATERBORNE OIL
Adlard, E.R. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of
Petroleum in the Marine Environment, Airlie, Virginia, 1973.
Washington, D.C., National Academy of Sciences. Vol. 1. p. 111-133.

Oil spills, Analytical techniques, Chemical analysis

The European experience in the identification of waterborne oil is reviewed and conclusions on pollutant analysis reached from past oil pollution incidents are presented. A general scheme of oil pollutant analysis is proposed which uses x-ray fluorescence analysis, emission spectrometry, gas chromatography, infra-red spectroscopy, and other techniques.

[from Selected Water Resources Abstracts 9(11):#W76-05143. 1976]

C-1844-76
PETROLEUM IDENTIFICATION BY LASER RAMAN SPECTROSCOPY
Ahmadjian, M., and C.W. Brown. 1976.
Analytical Chemistry 48(8):1257-1259.

Oil spills, Analytical techniques, Spectroscopy

Laser-Raman spectroscopy was tested for use in fingerprinting oil spills. Various oils, including No. 2 fuel oil, kerosenes and actual spill oils, were analyzed and Raman spectroscopy was found to be a fast and simple method for identifying the petroleum products.

C-1845-76
OIL DRILLING RISKS!
Anon. 1976.
Scandinavian Oil and Gas Magazine 4(5):22.

Oil spills, Oil discharges, Tankers, Oil industry

Marine oil pollution sources other than offshore blowouts are identified. Accidental and intentional discharges by tankers and other ships are the single greatest source of pollution, followed by industry and semipublic institutions. The article comments on the inadequate state of preparedness for oil spill events.

[from Petroleum Abstracts 16(30):#222,629. 1976]

C-1846-76
POLYNUCLEAR AROMATIC HYDROCARBONS (news brief)
Anon. 1976.
Chemistry in Canada 28(6):17.

PAH, Aromatic hydrocarbons, Carcinogens, Contamination, Canada

Recent studies by the Ontario Ministry of the Environment indicate the wide spread occurrence of polynuclear aromatic hydrocarbon (PAH) compounds in the environment. The sources of such PAH compounds, many of which are known carcinogens, include asphalt plants, combustion of fuel oil, and incineration of carbonaceous wastes. These compounds are not easily removed by waste treatment methods and are stable and persistent in the environment.

C-1847-76
THE SOURCES OF OIL ENTERING THE SEA
Brummage, K.G. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 1-6.

Oil spills, Oil discharges, Oceans, Tankers, Ships

The main sources of oil entering the sea were reviewed and included tanker cargo operations, tanker accidents, ship accidents, offshore oil operations, refineries, discharges on land, and bilges, bunkering, etc. The total amount of oil entering the sea was estimated to be 2.55 million tons per annum, 39% of which is due to tanker operations.

[from Selected Water Resources Abstracts 9(11):#W76-05136. 1976]

C-1848-76
OIL POLLUTION ALONG GUJURAT COAST AND ITS POSSIBLE SOURCE
Divivedi, S.N., B.N. Desai, A.H. Parulekar, V. Josanto, and M.D. George. 1974.
Mahagasar 7(1-2):91-94.

Contamination, Chemical analysis, Coasts, India

Summary not available.

[from Underwater Information Bulletin 8(2):7604/1308. 1976]

C-1849-76
THE U.S. COAST GUARD RESEARCH AND DEVELOPMENT CENTER OIL SPILL FORENSIC IDENTIFICATION SYSTEM: AN EVALUATION
Giles, H.N., and J.R. Jadamec. 1976.
U.S. National Bureau of Standards Material Resources Symposium, 8th, Gaithersburg, Maryland, 1976. p. 23-24. Abstract.

Oil spills, Sampling, Analytical techniques, *U.S. Coast Guard

The U.S. Coast Guard has developed a comprehensive system for the positive source identification of oil spills which includes procedures for sampling, sample transmittal, classification, and fingerprinting by an array of analytical techniques. Gas chromatography, thin-layer chromatography, infrared spectroscopy, ultraviolet fluorescence spectroscopy, and a number of secondary techniques are applied to provide a statistical probability of correctness of > 99.99% for any samples matched.

[from Petroleum Abstracts 16(33):#223,742. 1976]

C-1850-76
TRACE ORGANIC COMPONENTS AS FINGERPRINTS IN GAS CHROMATOGRAPHIC IDENTIFICATION OF SPILLED ASPHALTS
Kawahara, F.K. 1976.
Environmental Science and Technology 10(8):761-765.

Chemical analysis, Chromatography, Oil spills

The development and testing of a new concept for oil identification using electron capture-gas chromatography is discussed. This technique separates the perfluorobenzyl thioethers and ethers which are derivatives of weak acids present in discharged petroleum products. The chromatograms of these ethers serve as fingerprints for identification.

C-1851-76
CHARACTERIZATION OF OIL SPILLS BY CAPILLARY COLUMN GAS CHROMATOGRAPHY
Rasmussen, D.V. 1976.
Analytical Chemistry 48(11):1562-1572.

Oil spills, Chemical analysis, Chromatography

Hydrocarbon oil spills have been successfully identified using gas chromatography. One method of analysis is described and both liquid and solid oil spill samples are identified using a 30 m (100 ft) Dexsil-300 Support Coated Open Tube column.

C-1852-76
IDENTIFICATION OF WATERBORNE OILS
Weiss, F.T. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p. 290a-306.

Analytical techniques, Sampling, *Waterborne oils

This review compares the principal techniques for the identification of waterborne oils. A tabular summary is included to indicate the significant features of each technique. Information is also presented on the important and practical aspects of sampling, preservation, and treatment prior to analysis.

[from Selected Water Resources Abstracts 9(11):#W76-05150. 1976]

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

C-1853-76
OIL SPILL BOOM
(Inventor unknown) 1976.
Australian Patent 469,274

Oil spills, Booms, Design and engineering

An oil spill containment boom consists of a series of interconnected ballasted floats to which a continuous screen barrier is attached. The float assembly is designed to counteract heeling forces due to movement of water and to retain the boom in a stable position.

[from Petroleum Abstracts 16(30):#222,631. 1976]

C-1854-76
BOOM (product information)
Anon. 1976.
Environmental Science and Technology 10(8):820.

Booms, Oil spills, Design and engineering

"Designed to contain oil spills or to serve as oil barriers, the boom is manufactured in 20 ft (6.1 m) sections with 9 in (23 cm.) diameters, polyfoam pellet-filled bladder and an 18 in (46 cm) skirt and chain ballast. Sections can be connected by vinyl zippers." FFI contact Environetics, Inc.

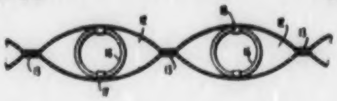
C-1855-76
FLOATING ANTI-POLLUTION BARRIER
Ballu, L. 1975.
U.S. Patent 3,919,847

Oil spills, Design and engineering

The barrier is designed to catch floating articles or substances including oil and consists of one or more floating elements and a skirt made of a flexible material such as fabric impregnated with rubber.

[from Selected Water Resources Abstracts 9(8):#W76-03513. 1976]

3,919,847
FLOATING ANTI-POLLUTION BARRIER
Louis Ballu, Colombes, France, assignor to Pneumatiques, Caoutchouc Manufacture et plastiques Kleber-Colombes, France
Filed Nov. 27, 1973, Ser. No. 419,334
Claims priority, application France, Nov. 27, 1972, 72.42160
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 61—1 F **8 Claims**



C-1856-76
HIGH SEAS OIL CONTAINMENT BARRIER MOORING SYSTEM
Bitting, K.R. 1975.
Final report, USCG-D-176-75. 128p.

Oil spills, Design and engineering, *Mooring device

Designed, fabricated and tested to moor the Air Deployable Lightweight High Seas Oil Containment Barrier of the U.S. Coast Guard's High Seas Oil Spill Response System, this mooring device consists of an inflatable buoy, anchor, and delivery container. The mooring system was built to be deliverable by helicopter and to have a delivery radius of 130 km (70 nautical miles).

[from Government Reports Announcements 76(8):#AD-A020 980/9GA. 1976]

C-1857-76
A CONNECTOR HINGE FOR OIL CONTAINMENT BOOMS
Campbell, F.J., and D.J. Graham. 1975.
U.S. Patent Application AD-D002 089/1

Booms, Oil spills, *Connector hinge

A connector hinge for attaching oil spill containment booms has a male cylindrical connector which fits loosely within a female cylindrical connector to allow easy movement in both a vertical and horizontal direction.

[from Government Reports Announcements 76(9):#PAT-APPL-606 696/GA. 1976]

C-1858-76
OIL SPILL CONTROL NEARS FOR TWO PESKY PROBLEMS
Iammartino, N.R. 1976.
Chemical Engineering 83(10):76, 78, 80.

Recovery, Oil spills, Coasts, Shorelines

Oil spill control technology has greatly advanced since the late 1960's; and cooperative government-industry oil spill response teams can now handle many of the 15,000 spills reported each year in or near U.S. waters. Present research and development efforts are focused on containment and recovery of oil from fast-moving waters and on the protection of shorelines from oil spills not contained offshore.

[from Petroleum Abstracts 16(27):#221,567. 1976]

C-1859-76
OIL COLLECTION AGENTS AND THEIR USE IN CONTAINING OIL SLICKS
Canevari, G.P. 1976.
U.S Patent 3,959,134

Cleanup, Oil slicks, *Oil-collecting agents

A method for collecting oil from water surfaces using aliphatic carboxylic acids and sorbitan monoacrylates is described. These compounds in combination with nonpolar solvent systems are effective oil collecting agents which reduce the area of the oil slick.

[from Petroleum Abstracts 16(34):#223,965. 1976]

C-1860-76
EVALUATION OF A PNEUMATIC BARRIER FOR OIL CONTAINMENT
Grace, J.M. 1976.
Final report, EPA/600/2-76/030. 77p.

Design and engineering, New York, *Buffalo River, *Air barrier

The development and evaluation of a pneumatic barrier for restraining the natural flow of surface oils in the Buffalo River was investigated. Based on laboratory experiments, a full scale, prototype air barrier system was designed, built and installed in the river. Tests were run to evaluate the performance of the barrier in varying current speeds; a limiting speed of 0.5 m per second was found.

[from Government Reports Announcements 76(8):#PB-249361/7GA. 1976]

C-1861-76
FLOATING BOOM
King, G. 1976.
Australian Patent 470,555

Booms, Design and engineering

A floating containment boom is composed of a number of individually inflated and ballasted sealed tube sections that are joined end-to-end. The boom is designed to be interconnectible with adjacent sections of the boom so as to confine or contain small areas.

[from Petroleum Abstracts 16(30):#222,625. 1976]

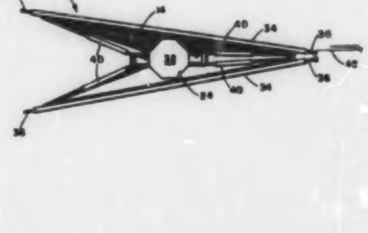
C-1862-76
RETRIEVAL MEANS FOR A FLOATING LIQUID SPILLING
Kirk, W.P., and D.W. Reynolds. 1976.
U.S. Patent 3,963,617

Oil spills, Cleanup, Design and engineering

"A flexible sheet has weight means adapted for spreading the sheet over a liquid spilling and caused it to collapse into a floating position, thereby confining and concentrating a quantity of the spilling. The sheet has central flotation means and a vent for release of entrapped air."

[from Petroleum Abstracts 16(37):#224,754. 1976]

3,963,617
RETRIEVAL MEANS FOR A FLOATING LIQUID SPILLING
William P. Kirk, 22 Glenhaven Circle, Saco, Maine 04072, and Dwight W. Reynolds, R.F.D. 1, Box 49, Pownal, Maine 04069
Filed Jan. 22, 1975, Ser. No. 543,169
Int. Cl.^{2} E02B *15/04*



C-1863-76
ON THE USE OF AIR-BUBBLE SCREENS AS OIL BARRIERS
Kobus, H.E. 1975.
Fundamental Tools to be Used in Environmental Problems. Proceedings of the 16th Congress, Sao Paulo, Brazil, 1975. Brazil, International Association for Hydraulic Research, 1975. Vol. 3, Subject C, Hydron. Aspects in Environmental and Ecological Enhancement, p. 356-363.

Booms, Oil spills, Design and engineering

A pneumatic oil barrier was designed, based on a flow field induced by an air-bubble screen, giving a surface current which can be predicted as a function of water depth and air discharge.

[from The Engineering Index Monthly 14(7):#049871. 1976]

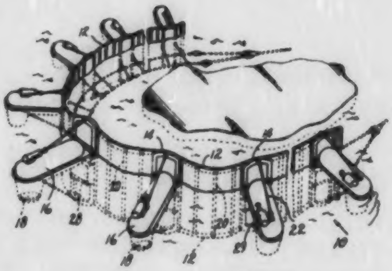
C-1864-76
FLOATING OIL BARRIER
Milgram, J.H. 1976.
U.S. Patent 3,943,720

Oil spills, Booms, Design and engineering

The patent relates to an oil containment boom with floats and counterweights designed to prevent churning of the oil and water inside the barrier and subsequent leakage in rough sea conditions.

[from Petroleum Abstracts 16(23):#220,479. 1976]

3,943,720
FLOATING OIL BARRIER
Jerome H. Milgram, Cambridge, Mass., assignor to Offshore Devices, Inc., Lynn, Mass.
Filed Aug. 30, 1974, Ser. No. 501,870
Int. Cl.² E02B *15/04*
U.S. Cl. 61—1 F **8 Claims**



C-1865-76
DEVELOPMENT AND EVALUATION OF AN OIL CONTAINMENT BARRIER SEQUENTIAL AERIAL DELIVERY SYSTEM
Morrison, R.S., and J.B. Warren. 1975.
AFFTC-TR-75-1, 1975. 102p.

Oil spills, Design and engineering, *Barrier delivery system

Several land-impact tests were made from various altitudes using weight-test platform loads. Forces, velocities, and event times were measured, and from these data an oil containment barrier sequential aerial delivery system was developed for use by the U.S. Coast Guard.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q3195. 1976]

C-1866-76
RESEARCH, DESIGN, AND DEVELOPMENT OF THE U.S. COAST GUARD HIGH SEAS OIL CONTAINMENT SYSTEM
Tierney, J.M. 1975.
Final report, USCG-D-42-76, Contract DOT-CG-23223-A. 318p.

Booms, Oil spills, Design and engineering

The development of a lightweight, air-deliverable oil barrier system capable of containing oil in sea waves of 1.5 m and winds of over 35 km/hr is reviewed. A full-scale working model was built and tested; the results show the oil barrier to be effective at sea.

[from Government Reports Announcements 76(16):#AD-A025749/3GA. 1976]

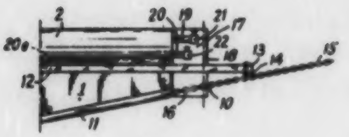
C-1867-76
FLOATING CONTAINING VESSELS OR DAMS FOR TRAPPING LIQUID POLLUTANTS
Vidilles, J. 1975.
U.S. Patent 3,922,862

Oil slicks, Design and engineering, Booms

The vessel is designed to confine slicks of liquid pollutants. The invention consists of a flexible skirt connected at its upper portion to a float which provides buoyancy, and at its lower portion to a ballast. The skirt forms an enclosure wherein the pollutants collect, and the ballast provides a means for towing the containing vessel.

[from Selected Water Resources Abstracts 9(9):#W76-04274. 1976]

3,922,862
FLOATING CONTAINING VESSELS OR DAMS FOR TRAPPING LIQUID POLLUTANTS
Jacques Vidilles, 24 boulevard Maillot, 92000 Neuilly, France
Filed July 10, 1974, Ser. No. 487,288
Claims priority, application France, Aug. 16, 1973, 73.29908
Int. Cl.² E02B *15/04*
U.S. Cl. 61—1 F **8 Claims**



2. CLEANUP AND RECOVERY

C-1868-76
INSTALLATION TO SKIM AN OIL LAYER FROM A WATER SURFACE
(Inventor unknown) 1974.
Netherlands Application 7,411,281

Oil spills, Cleanup, Recovery, Skimmers

A floating oil skimming container is provided with a means to conduct oil into the container and is connected with a pumping apparatus to recover the skimmed oil. One side of the container is open and has a specially designed, hinged, buoyant flap which controls and ensures oil intake and prevents outflow.

[from Petroleum Abstracts 16(30):#222,627. 1976]

C-1869-76
CHEMICAL OIL ABSORBENT (product information)
Anon. 1976.
Environmental Science and Technology 10(8):820.

Cleanup, Oil spills, Absorption

"The non-caking powder absorbs up to 200 times its weight in chemical and oil spills. It is non-flammable, contains no phosphates and will not irritate skin." FFI contact Manostat Corporation.

C-1870-76
HELICOPTER WILL TOW SEA SLED TO POLLUTION SITE
Anon. 1975.
Ocean Industry 10(8):130.

Cleanup, Recovery, Oil spills, *Sea sled

A planing hull sled for fast surface delivery of equipment and systems for controlling oil pollution on the high seas has been developed by the Naval Coastal Systems Laboratory. By use of a helicopter or boat, the sled can be used to tow an oil containment barrier, oil recovery device, and pumping equipment.

[from Oceanic Abstracts 13(4):#76-03579. 1976]

C-1871-76
HYDROCARBON RECOVERY TECHNIQUES (in French)
Anon. 1976.
Industrie du Petrole Monde Gaz-Chimie 44(469):52-53.

Recovery, Cleanup, Containment, Hydrocarbons, Oil spills

The recovery, containment, and cleanup of hydrocarbons on surface waters are discussed in detail with emphasis on methods and equipment.

[from Petroleum Abstracts 16(35):#224,221. 1976]

C-1872-76
JBF DEBRIS HANDLING SYSTEM (product information)
Anon.
JBF Scientific Corporation, Wilmington, MA. U.S. Navy Contract N00600-75-C-0948.

Cleanup, Oil spills, Design and engineering, *Debris handling

The design and development of a debris handling system for both heavy and light oils with fibrous and hard debris are described. The system has two parts: one is a grinding unit which reduces oil mixtures to a slurry, and the other is a clamshell basket crane which collects and removes the processed slurry from the grinder.

C-1873-76
LOCKHEED CLEAN SWEEP OIL RECOVERY SYSTEM
Anon. 1975.
Sunnyvale, Calfornia, Lockheed Missiles and Space Company, 1975. 18p.

Recovery, Oil spills, Design and engineering

The Clean Sweep oil recovery device Model R2003 is designed to recover oil spills from the high seas, harbors, bays, and estuaries at a maximum oil discharge rate of 1300 l/min (350 gal/min). The device is mounted on a self-propelled vessel and a 6-cylinder HR-6 diesel engine provides hydraulic power for the propulsion units, the oil recovery device, the recovered oil discharge pump, and an electrical generator.

[from Oceanic Abstracts 13(3):#76-02654. 1976]

C-1874-76
MIPOS (MODEC INCLINED PLANE OIL SKIMMER)
Anon. (product information)
Mitsui Ocean Development and Engineering Company, Ltd.

Oil spills, Recovery, Skimmers, Design and engineering,

The brochure describes a line of twelve different types of MODEC inclined plane oil skimmer systems. The systems have a number of advantageous features, such as no moving parts in the oil recovery system, high recovery rates and efficiencies, effectiveness in rough seas, and adaptability to existing ships. A wide variety of oil can be recovered with these systems.

C-1875-76
NEW CHEMICAL METHOD FOR THE CONTROL OF SEA WATER POLLUTION
Anon. 1976.
Indian Journal of Environmental Health 18(2):156-157.

Oil slicks, Cleanup, Weathering, Germany, West, *Photochemical dissolution

The West German Federal Ministry of Research and Technology is supporting a program of research into chemicals that help accelerate photochemical dissolution of floating oil layers on water. The chemical substance would be sprayed on the oil slicks and would be especially useful for removing oil residues after the main quantity has been cleaned up and recovered. Battelle Institute of Frankfurt is conducting the basic research effort.

C-1876-76
NORTH SEA OIL RECOVERY
Anon. 1976.
Marine Pollution Bulletin 7(6):101.

Recovery, Oil spills, Offshore drilling, North Sea

A new oil recovery system has been developed jointly by several Norwegian oil companies. The system is especially useful in dealing with a blowout on an offshore platform. It consists basically of three components: (1) a mother ship, (2) a boom to contain and collect the oil, and (3) a catamaran-type skimmer to remove the oil.

C-1877-76
OIL AND ESTUARY POLLUTION CONTROL: A QUICK LOOK AT SOME DEVELOPMENTS
Anon. 1975.
Water and Waste Treatment Journal 18(7):24-28.

Oil slicks, Estuaries, Oil-water separation, Cleanup, Recovery

"Oil-water separators, application of the plate separator, automatic separation of oil from waste, oil slick control, absorbents for land and water, and wringing machines are discussed. The 1975 Conference on Prevention and Control of Oil Pollution is reviewed. A new salvage collection boat designed to combat floating debris, oil, fuel oil and seaweed is described."

[from Pollution Abstracts 7(2):#76-01455. 1976]

C-1878-76
OIL POLLUTION CENTER FOR MEDITERRANEAN
Anon. 1975.
Chemical and Engineering News 53(42):14.

Oil spills, Cleanup, Monitoring, Mediterranean Sea, Personnel training

Malta, located nearly in the middle of the Mediterranean Sea, has been chosen as the probable site for a regional oil pollution control center. The center would combat oil pollution and massive oil spills, monitor hydrocarbons and oil in the Mediterranean, inventory and coordinate cleanup equipment and supplies, and train cleanup teams and specialists.

C-1879-76
OIL SKIMMER (product information)
Anon. 1976.
Sea Technology 17(8):53.

Recovery, Oil spills, Skimmers, Design and engineering

"Aluminum SLURP (Self-Leveling Unit for Removing Pollution) weighs only 36 lbs (16 kg); has recovery capacity in excess of 1800 gal (6800 l) per hour; skimming depth adjustable simply by changing pump flow rate." FFI contact Seaward International.

C-1880-76
OIL SPILL CLEAN-UP (product information)
Anon. 1976.
Offshore 36(8):138.

Recovery, Oil spills, Skimmers, Design and engineering

The Komara, a floating, donut-shaped oil spill recovery device marketed by Marine Construction and Design Company, uses a ring of rotating discs to collect oil encountered at any point around its circumference. The efficiency of the miniskimmer is not affected by debris in water or moderate waves.

C-1881-76
OIL SPILL RECOVERY
Anon. 1976.
Marine Pollution Bulletin 7(5):83.

Recovery, Oil spills, Absorption, Design and engineering

A new polyurethane foam oil spill recovery system has been developed by the U.S. Naval Civil Engineering Laboratory at Port Hueneme, California. The system sprays over 3 million chips per hour of polyurethane foam and can pick up 190,000 l (50,000 gal) per hour of oil while operating in winds as high as 45 km/hr (25 knots).

C-1882-76
ROTORK SEA TRUCK (product information)
Anon.
Rotork Marine Ltd., Westbury, Wiltshire, BA13 4JT England.

Oil spills, Cleanup, *Rotork Sea Truck

The pamphlet describes the Rotork Sea Truck MK-4 line of flat-bottomed, square-hulled, shallow-draft vessels. The versatile boats are adaptable for use in oil spill cleanup operations in deep water and also extremely shallow water environments; as they have a draft (unloaded) of only 0.33 m.

C-1883-76
SCAVENGER OIL RECOVERY SYSTEM (product information)
Anon.
Oil Recovery Systems, Inc. Mason, NH 03048.

Recovery, Oil spills, Skimmers, Design and engineering

The company produces the Scavenger Oil Recovery System, a portable, floating skimmer with built-in oil-water separator cartridge, pump control switch, and an explosion-proof motor pump assembly capable of recovering up to 1135 l/hr (300 g/hr) of light oils, gasoline, jet fuel, or diesel oil from the surface of water.

C-1884-76
SLICK SOLUTION FOR OIL SLICKS
Anon. 1976.
DuPont Magazine March-April:29.

Cleanup, Absorption, Oil slicks

Gitlin Industries, Westport, Massachusetts, has announced a new concept in oil-soak bags for containment and absorption of oil slicks. The bag is made of "Typar", a spunbonded polypropylene which encases a synthetic sponge-like material that soaks up oil. Each bag can collect up to 30 times its weight in oily liquid.

[from Energy Review 15:24. 1976]

C-1885-76
SURFACE SKIMMER (product information)
Anon. 1976.
Environmental Science and Technology 10(8):820.

Cleanup, Oil spills, Design and engineering, Skimmers

"Removes oil and other floating liquid or semi-liquid material from the surface of water. Features include a 3 in (7.6 cm) outlet, a 27 in (69 cm) weir, and six ballasts. Capacity governed by size of the pump, house, and material being skimmed." FFI contact Industrial and Municipal Engineering Company.

C-1886-76
U.S. AND FRANCE SHARE OCEAN PLANS
Anon. 1976.
Science News 109(22):343.

Pollution prevention, Oil spills, Recovery, International agreements, U.S., France

Several U.S. agencies and France have recently broadened a mutual exchange of information agreement on ocean studies. Among the varied topics are cooperative research in the prevention and control of marine pollution and oil spills, and exchange testing of each other's oil spill containment and recovery systems.

C-1887-76
AGENT FOR TREATMENT OF OIL SPILL
Abe, K., S. Tomita, D. Terashima, Y. Matsuda, and Y. Morita. 1975.
Japanese Kokai (unexamined patent application) 75,159,878

Oil spills, Cleanup, Coagulation

Carboxymethylated petroleum protein forms a stable, dry and nontoxic powder which can be used as an agent to control and agglomerate oil spillage without causing secondary pollution.

[from Chemical Abstracts 85(2):#10071f. 1976]

C-1888-76
ABSORBER FOR HYDROCARBON OIL
Akimoto, M., and H. Ishida. 1975.
Japanese Kokai (unexamined patent application) 75,27,833

Cleanup, Oil spills, Adsorption

"Polypropylene fibers were used as adsorbents for oil spills on waters. Polypropylene (10-70 isotacticity) was spun in an apparatus by a rotary nozzle in the presence of N atmosphere."

[from Chemical Abstracts 85(2):#10060p. 1976]

C-1889-76
USE OF CRUDE XYLITE CONTAINED IN CRUDE LIGNITE
Baake, C., H. Langnickel, and K. Neuenberg. 1975.
East German Patent 113,563

Cleanup, Oil spills, Adsorption

Partially coked xylite ash is effective as an adsorbent in removing oil from polluted water.

[from Chemical Abstracts 85(4):#23506p. 1976]

C-1890-76
THE APPLICATION OF SKIMMERS, PISTON FILMS, AND SORBENTS FOR OPEN WATER SPILLS
Bianchi, R.A., E.E. Johanson, and J.H. Farrell. 1973.
Offshore Technology Conference, 5th Annual, Houston, 1973. OTC Paper No. 1746. 14p.

Cleanup, Containment, Oil spills, Skimmers, *Sorbents, *Piston films

A series of tests were conducted to evaluate the use of skimmers, piston films, and sorbents in oil spill cleanup. Piston films were effective in preventing the oil from spreading and sorbents made the slick highly visible to the skimmer operator. Skimmers were especially effective on oil escaping from booms, but oil transfer systems were inadequate.

C-1891-76
REDESIGN, FABRICATION AND TEST OF A 1000-GPM HIGH SEAS OIL RECOVERY SYSTEM
Blockwick, T.N., and R.J. Smith. 1975.
Ocean Systems Inc., CG-D-182-75. 109p.

Recovery, Oil spills, Design and engineering

Improvements and modifications of a 3800 l/m (1000 gal/m) high seas oil recovery system are discussed. Changes in the system were made in the weir/basin and included the elimination of the trailing hoses.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4275. 1976]

C-1892-76
REMOVAL OF OIL AND OTHER IMPURITIES FROM SURFACE WATER BY MECHANICAL MEANS
Blommenstein, F.A., and G.F. Geurts. 1974.
Lausanne, Switzerland, Elsevier Seguoia, 1974. Patent Report 1. vi + 116 p.

Oil spills, Containment, Cleanup, Recovery, Oil-water separation, Disposal

Patent Report 1, which deals with patents and patent applications related to the containment of oil and other pollutants from surface water, contains four sections: (1) barriers for preventing the spread of a contaminant, (2) means to collect or separate the contaminant from water, (3) binding or adsorbing agents, and (4) combustion methods. The report lists 670 items, and an automatic updating service is included for 1975, 1976 and 1977.

[from Marine Pollution Bulletin 7(3):55. 1976]

C-1893-76
PRACTICAL RECOMMENDATIONS FOR OIL SPILL DEBRIS DISPOSAL: A PROGRESS REPORT
Farlow, J.S., and D.E. Ross. 1976.
Paper presented at Tucson, Arizona, February 2, 1976. 5p.

Oil spills, Disposal, Manuals, Guidelines

The U.S. Environmental Protection Agency has retained SCS Engineers, Inc. to prepare a detailed, practical how-to-do-it manual for oil spill debris disposal and to make an accompanying film for state and local officials. A literature search has been conducted and sites for confirming field studies chosen. Present recommendations for disposal of recyclable material include soil cultivation, incorporation into an approved sanitary landfill, and individual burial. A description of the rationale for selecting certain disposal methods and findings to date are presented.

C-1894-76
METHOD FOR REMOVAL OF OIL FROM LAND OR WATER SPILLS
Condo, A.C. 1976.
Canadian Patent 991,158

Cleanup, Oil spills, Absorption, *Polystyrene beads

Activated expanded polystyrene beads remove oil from land or water surfaces. When coupled with fillers such as clay or straw, better adsorption is obtained throughout the beads.

[from Petroleum Abstracts 16(34):#223,962. 1976]

C-1895-76
THE BEHAVIOUR OF A VORTEX ASSISTED OIL RECOVERY SYSTEM
Copp, D.A. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 90-91.

Recovery, Oil spills, Design and engineering

The vortex recovery system involves the use of a mechanically created vortex to concentrate the oil on the surface, thus facilitating recovery. This recovery system was studied and the information was used to design a pilot scale system.

[from Petroleum Abstracts 16(28):#221,982. 1976]

C-1896-76
UK OIL CLEARANCE TECHNIQUES AND EQUIPMENT
Cormack, D., and J.A. Nichols. 1976.
Petroleum Times 80(2026):23,25,27-28.

Oil spills, Weathering, Cleanup, Booms, Skimmers, Absorption

"Various possible methods of dealing with oil at sea, in inshore waters and beaches were considered and evaluated, having regard to the full range of oil properties and the changes therein brought about by weathering processes in the spilled oil. The following methods are discussed: mechanical, natural processes, burning, sinking, absorbing, booms and skimming."

[from Petroleum Abstracts 16(32):#223,464. 1976]

C-1897-76
SYSTEM TO DETERMINE AND CATCH OIL OR SIMILAR POLLUTANTS IN SURFACE AND UNDERGROUND WATER
Durham Associates. 1975.
Netherlands Application 7,509,885

Detection, Recovery, Contaminants, Groundwater, Design and engineering

A system which determines and selectively transmits oil or other floating liquid pollutants is described. The system consists basically of a chamber into which the pollutants are introduced and collect at the top of the water surface. Specially designed floats in the chamber indicate the presence of the pollutant and activate the selective transmitter element which sequesters and traps the oil.

[from Petroleum Abstracts 16(32):#222,639. 1976]

C-1898-76
A PROBABILISTIC MODEL FOR DISPERSIVE OIL LOSSES BENEATH OIL BOOMS
Fallah, M.H., and R.M. Stark. 1975.
Civil Engineering Department, University of Delaware, Technical report. 12 p.

Models, Booms, *Oil losses

Summary not available.

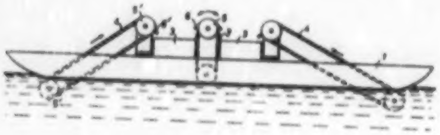
C-1899-76
ENVIRONMENT PROTECTIVE OIL SKIMMING AND REMOVAL APPARATUS
Fast, S.G., 1976.
U.S. Patent 3,947,360

Oil spills, Recovery, Skimmers, Design and engineering

A boat with apparatus for collecting and storing oil spilled on a water surface is described. The apparatus consists basically of a conveyor belt which brings skimmed oil to an onboard holding tank.

[from Petroleum Abstracts 16(24):#220,652. 1976]

3,947,360
ENVIRONMENT PROTECTIVE OIL SKIMMING AND REMOVAL APPARATUS
Sven Gunnar Fast, Sandviken, Sweden, assignor to Sandco Limited, Ottawa, Canada
Continuation of Ser. No. 391,554, Aug. 27, 1973, abandoned.
This application Oct. 21, 1974, Ser. No. 516,763
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 S **3 Claims**



C-1900-76
OIL SKIMMER
Fast, S.G. 1976.
British Patent 1,435,343

Recovery, Oil spills, Skimmers, Design and engineering

An oil skimming vessel has a vertically mounted conveyor belt system designed to pick up and discharge oil in a centrally located storage tank while the vessel moves through the oil spill.

[from Petroleum Abstracts 16(27):#221,565. 1976]

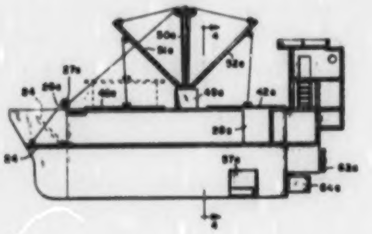
C-1901-76
WATERCRAFT FOR SCAVENGING OIL SPILLAGE
Fletcher, G.M. 1975.
U.S. Patent 3,929,644

Recovery, Oil spills, Skimmers, Design and engineering

The self-propelled watercraft has a catamaran-type hull with receiving tanks extending downward below the surface of water in each of the hull sections. The craft is open at the bow to permit a surface layer of water to wash rearward along the deck toward the inlet openings of each tank as the craft moves through the water. Spilled oil is lighter than water and therefore floats while the water settles to the bottom of the tank and is removed via the exit opening.

[from Selected Water Resources Abstracts 9(12):#W76-05548. 1976]

3,929,644
WATERCRAFT FOR SCAVENGING OIL SPILLAGE
George M. Fletcher, 456 Lee St., Oakland, Calif. 94610
Filed Dec. 28, 1970, Ser. No. 101,964
Int. Cl.² E02B *15/04*
U.S. Cl. 210—242 **5 Claims**



C-1902-76
COMPUTER SIMULATION AIDS OIL-SPILL CLEANUP DECISIONS
Fraser, J.P., and R.A. Cochran. 1976.
Oil and Gas Journal 74(10):67-72.

Recovery, Cleanup, Oil spills, *Computer simulation

Computer simulation as a method for selecting and designing oil spill control equipment is discussed. Performance characteristics of oil spill control equipment and the effects of weather on the recovery of spilled oil are assessed by the computer; the data can be used to choose the best cleanup equipment.

[from The Engineering Index Monthly 14(5):#035572. 1976]

C-1903-76
DEALING WITH OIL SPILLAGE CONTAMINATION
Gass, T.E. 1975.
Water Well Journal 29(10):32-33.

Cleanup, Oil spills, Contamination, *Well water

Several methods are described to purify well water or aquifers contaminated by oil. The methods include pumping the well to waste, charcoal filtration, installation of Imbiber Beads, removal of contaminated soil, and installation of a new well.

[from Selected Water Resources Abstracts 9(8):#W76-03513. 1976]

C-1904-76
TESTS OF OIL RECOVERY DEVICES IN ICE COVERED WATERS
Getman, J.H., L.A. Schultz, and P.C. Deslauriers. 1975.
International Conference on Port and Ocean Engineering Under Arctic Conditions, 3rd, University of Alaska, 1975.

Oil spills, Recovery, Arctic, Fuel oil, Crude oil, *Operations tests

The U.S. Coast Guard conducted tests on two oil spill recovery devices operating in a simulated arctic environment to determine the oil recovery capability of the two devices in broken freshwater ice and broken saltwater ice using No. 2 diesel oil and crude oil. These tests demonstrated that with minor hardware modifications and proper operating procedures, both devices will successfully recover crude oil and No. 2 diesel oil spilled in a broken ice field of moderate ice piece size.

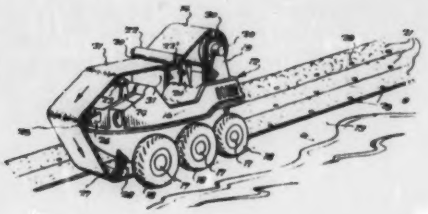
C-1905-76
APPARATUS AND METHOD FOR PROTECTING A SHORELINE AGAINST CONTAMINATION FROM AN OIL SPILL
Goldman, M. 1975.
U.S. Patent 3,962,083

Oil spills, Pollution prevention, Shorelines, Absorption, Design and engineering

A portable web laying vehicle equipped with a number of oil absorbing webs can lay the material along the shoreline for protection against oil spills. The web, a polyolefin fiber mesh, absorbs the oil and can be picked up and wrung dry.

[from Petroleum Abstracts 16(35):#224,217. 1976]

3,962,083
APPARATUS AND METHOD FOR PROTECTING A SHORELINE AGAINST CONTAMINATION FROM AN OIL SPILL
Max Goldman, Latham, N.Y., assignor to RRC International, Inc., Latham, N.Y.
Continuation of Ser. No. 417,478, Nov. 19, 1973, abandoned.
This application Feb. 27, 1975, Ser. No. 553,592
Int. Cl.^{2} B01D *41/02*; C02B *9/02*; E02B *15/04*
U.S. Cl. 210—79 **24 Claims**



C-1906-76
FAST CURRENT OIL RESPONSE SYSTEMS TESTS ON PHASE I CONCEPTS
Graebel, W.P. and V.A. Phelps. 1975.
Final report, USCG-D-20-76, Contract DOT-CG-32430-A. 319p.

Recovery, Oil spills, Skimmers, Design and engineering, *Systems tests

Several concepts for fast current oil response systems (skimmers) were tested at The University of Michigan Fast Current Recirculating Channel. Fifty-one tests were scheduled for each device to enable competitive evaluation; the devices were listed in order of best performance. None of the concepts approached the stated goals of the Coast Guard but were an improvement over barriers by a factor of three.

[from Government Reports Announcements 76(11):#AD-A022 928/6GA. 1976]

C-1907-76
PARTICIPATION OF ENVIRONMENT CANADA IN THE PREVENTION, CONTAINMENT AND CLEAN-UP OF OIL AND CHEMICAL SPILLS ON THE PACIFIC COAST
Hatfield, C.T. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 18-20.

Government agencies, Canada, Pollution prevention, Cleanup, Oil spills, EIS

The Environmental Protection Service of Environment Canada is responsible for coordinating activities in hazardous material spill prevention, containment and cleanup, and the initiation of environmental impact studies resulting from incidents. A summary of intergovernment jurisdictional responsibilities for spill cleanup on the Pacific Coast is given, and statistics on spill events and spill sources are included.

[from Petroleum Abstracts 16(28):#221,967. 1976]

C-1908-76
OIL HERDER, A NEW AID FOR REMOVING OIL FROM WATER SURFACES [in German]
Hellmann, H. 1975.
Tenside Detergents 12(6):330-334.

Oil slicks, Spreading, Recovery, Cleanup, Toxicity, *Oil Herder

The activity of oil adsorbents and collectors is usually inhibited because of the tendency of floating oils to spread on water surfaces. Oil Herder reverses this process and concentrates oil films and oil slicks. Toxic effects of Oil Herder on aquatic life are discussed.

[from Chemical Abstracts 85(2):#10011y. 1976]

C-1909-76
PROCESS FOR REMOVING OIL FLOATING ON WATER
Hoffmann, F. 1976.
German Patent 1,634,014

Cleanup, Oil spills, Sinking agents

Solid particles having a hydrophobic surface and a specific gravity greater than 1.5 g/cu cm bind oil on a water surface and cause it to sink to the bottom. The particles are made hydrophobic by generating carboxylic acid amides at their surface.

[from Petroleum Abstracts 16(28):#221,984. 1976]

C-1910-76
DESIGN AND DEMONSTRATION OF A REMOTELY-CONTROLLED HIGH-SEAS OIL RECOVERY SYSTEM DIP 4001
JBF Scientific Corporation. 1974.
Final report, API Publication No. 4253. 88p.

Recovery, Oil spills, Design and engineering

The report describes the development program of a mechanical spilled-oil recovery system based on the JBF Dynamic Inclined Plane (DIP) device. The system requirements and system design, such as propulsion, oil transfer subsystem, and hydraulic subsystem, are discussed and the test program is covered.

[from Offshore Abstracts 3(1):#76-1516. 1976]

C-1911-76
SOME ASPECTS OF THE FORMATION, STABILIZATION, AND BEHAVIOUR OF WATER-IN-PETROLEUM EMULSIONS
Johnson, B.D. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 98-103.

Oil spills, Emulsions, Cleanup, Crude oil, Fuel oil

Asphalt- based crudes and fuel oils spilled into water rapidly form water-in-oil emulsions not amenable to certain cleanup techniques used for unemulsified oils. The increase of viscosity is the greatest change in properties resulting from emulsification. The objective of this study was to determine the effect and interrelation of water content, drop-size distribution, temperature, and asphaltene concentration on the viscosity of unweathered emulsions.

[from Petroleum Abstracts 16(28):#221,985. 1976]

C-1912-76
FEASIBILITY OF OIL SLICK REMOVAL FROM SEAWATER USING POWER LASERS
Laisk, E. 1976.
Environmental Science and Technology 10(8):814-815.

Cleanup, Crude oil, Oil slicks, Economics, Decomposition, Evaporation, *LASER

Laboratory tests were conducted using a high-power-cw CO_2 laser to investigate the conditions for the evaporation and decomposition of crude oil from a water surface. Decomposition requires about 25 times higher beam intensities than evaporation. Cost analyses indicate that a shipboard 500 KW laser could become competitive with other belt and filter separators if the overall efficiency of the laser exceeds 25% and if a pulsed operation is used.

C-1913-76
RENDERING OIL SPILLAGES EASILY DISPOSABLE
Merck Sharp Dohme Pty. Ltd. 1976.
Australian Patent 470,232

Oil spills, Cleanup, Disposal

A method for rendering oil spills readily disposable consists of distributing a hydrophobic, powdered material on the water surface. The material is composed of a mixture of one or more inorganic compounds and one or more specified silicone compounds.

[from Petroleum Abstracts 16(30):#222,638. 1976]

C-1914-76

ADSORBENTS FOR OIL SPILL

Nagahata, T. 1976.
Japanese Kokai (unexamined patent application) 76 23,493

Oil spills, Cleanup, Adsorption

"Polyvinyl alcohol and Na carboxymethyl cellulose films were used as adsorbents for oil spills. For example, 5g polyvinyl alcohol (surface area 100cm^2) and Na carboxymethyl cellulose (surface area 200cm^2) had crude oil adsorptions of 11.3 and 18.7g, respectively."

[from Chemical Abstracts 84(24):#169350j. 1976]

C-1915-76

OIL HERDER STUDIES

Nagy, E. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 118-120.

Cleanup, Containment, Oil spills, *Oil herders

Results of a laboratory technique to determine the effectiveness of oil-herding agents on various oils are presented. The oil-film thickness maintained by the herders agreed well with theoretical predictions for fresh oil samples, but the herders were ineffective on aged crude oil films. A surface balance has been designed to study the persistence of herders and the oil-herding action by compressed and expanded herder films.

[from Petroleum Abstracts 16(28):#221,983. 1976]

C-1916-76

FLOATAGE CONCENTRATING EQUIPMENT FOR NAUTICAL FLOATAGE RECOVERY APPARATUS

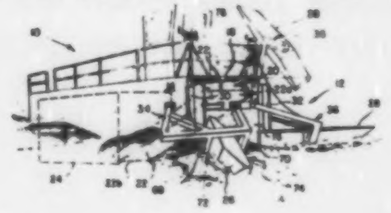
Neal, R.W. 1975.
U.S. Patent 3,926,812

Oil spills, Containment, Recovery, Design and engineering

A nautical vessel is described which is outfitted with an apparatus for concentrating, containing, and recovering floating substances such as oil in heavy seas. The apparatus consists of sweeps deployed forward and mounted so that they can move freely about both vertical and horizontal axes and yet maintain constant contact with the water surface.

[from Selected Water Resources Abstracts 9(11):#W76-05036. 1976]

3,926,812
FLOATAGE CONCENTRATING EQUIPMENT FOR NAUTICAL FLOATAGE RECOVERY APPARATUS
Robert W. Neal, Watertown, Mass., assignor to JBF Scientific Corporation, Burlington, Mass.
Filed Sept. 3, 1974, Ser. No. 502,393
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 9 Claims



C-1917-76
METHOD OF MANUFACTURING OIL COLLECTING MATERIAL
Nittan Co. Ltd. 1976.
British Patent 1,431,687.

Absorption, Oil spills, Waste oil

A method of manufacturing an oil collecting material from waste motor vehicle tires is described. The tires are pulverized, fibres are removed, and the rubber particles are recombined and formed into oil absorbent mats or sheets.

[from Petroleum Abstracts 16(25):#220,844. 1976]

C-1918-76
REMOVAL OF IMMISCIBLE FLUIDS FROM WATER SURFACES AND LAKE BEDS
Peterson, E.C. 1976.
Canadian Patent 986,911

Oil slicks, Cleanup, Recovery, Adsorption

A method for removing fluids such as oil from the water surface consists of adsorbing the liquid with an adsorbent compound made from 30-70% by weight lead slag mineral wool and rock flour coated with a hydrophobic, lipophilic film.

[from Petroleum Abstracts 16(23):#220,482. 1976]

C-1919-76
PROCESS FOR THE REMOVAL OF OIL AND LIKE SUBSTANCES FROM THE SURFACES OF AQUEOUS OR SOLID SUBSTRATES
Proctor, G.A.H. 1976.
British Patent 1,427,809

Cleanup, Recovery, Oil slicks, Adsorption

Bituminized wood fibers are found to be effective in adsorbing oil films from water surfaces or solid substrates.

[from Petroleum Abstracts 16(25):#220,842. 1976]

C-1920-76
2000 GPM OIL RECOVERY UNIT CONTROL SYSTEM ANALYSIS AND RECOMMENDATIONS
Reston Consulting Group, Reston, VA. 1975.
Redesign, Fabrication and Test of a 1000 GPM High Seas Oil Recovery System, Appendix C. No. CG-D-182-75. 19p.

Recovery, Oil spills, Design and engineering, *System analysis

Analysis of the control subsystem of the 2000 gal/min (7600 liters/min) oil recovery unit was made to determine if the overall design was compatible with the system operational requirements. Performance tests were also conducted on this system.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4268. 1976]

C-1921-76
APPARATUS FOR SEPARATING TWO LIQUIDS NOT MUTUALLY SOLUBLE AND HAVING DIFFERENT DENSITIES
Rotvand, G. 1975.
French Demande 2,263,018

Oil spills, Cleanup, Recovery, Oil-water separation, Design and engineering

An apparatus is described for separating immiscible liquids of different densities such as oil floating on water. The separating device consists of a floating receiver vessel which sinks in the lighter liquid but floats at the surface of the heavier liquid. Holes in the receiver just above the liquid-liquid interface permit the collection and separation of the floating liquid.

[from Chemical Abstracts 85(4):#23102d. 1976]

C-1922-76
ENVIRONMENTAL EMERGENCIES RESEARCH AND DEVELOPMENT DIVISION
Ruel, M., and S. Ross. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 136-139.

Government agencies, Canada, Cleanup, Oil spills, Guidelines

The Research and Development Division of the Environmental Emergencies Branch, Environment Canada, is responsible for the development and evaluation of effective and ecologically safe systems for combating hazardous materials spills and the development of research and technological information related to environmental emergencies. The Division also prepares guidelines and regulations pertaining to the chemicals used as countermeasures to deal with spills.

[from Petroleum Abstracts 16(28):#221,978. 1976]

C-1923-76
SALVAGING OF FLUIDS AND SIMILAR FROM SUNKEN SHIPS
Salvage Oil Systems. 1974.
Netherlands Application 7,409,079

Recovery, Crude oil, *Sunken ships, Design and engineering

An installation for salvaging crude oil and other fluids from sunken ships consists of a capsule that can be lowered to and tightly attached to the sunken ship by remote control. Drilling and pumping apparatus contained in the capsule then tap and remove the salvageable fluids from the ship to a container at the surface.

[from Petroleum Abstracts 16(23):#220,481. 1976]

C-1924-76
IMPROVEMENTS IN OR RELATING TO MARINE VESSELS FOR RECOVERING FLOATING POLLUTION
Sandford, W.H. 1976.
British Patent 1,440,978

Oil spills, Recovery, Oil-water separation, Ships, Design and engineering

Details of a marine vessel for recovering oil and other floating pollutants are presented. The vessel is designed to provide a large settling hold into which the pollutant is pumped and allowed to separate before being pumped into a vacuum storage tank. More complete separation and recovery is achieved in the storage tank.

[from Petroleum Abstracts 16(33):#223,744. 1976]

C-1925-76
TESTS OF OIL RECOVERY DEVICES IN BROKEN ICE FIELDS, PHASE II
Schultz, L.A. 1976.
Final Report No. 273-C, USCG-D-55-76; Contract DOT-CG-51487-A. 179p.

Oil spills, Crude oil, Fuel oil, Recovery, Skimmers, Design and engineering

Summarized are results of tests which measured the effectiveness of five oil spill recovery devices in removing crude oil and No. 2 fuel oil in broken ice cover. The recovery devices were manufactured by Lockheed, Marco, Ocean Systems, JBF Scientific, and Oil Mop. The natural spill thickness of crude oil and No. 2 fuel oil in open water and in broken ice cover was investigated.

[from Government Reports Announcements 76(16):#AD-A025748/5GA. 1976]

C-1926-76
REDUCING THE ADHERENCE OF OIL TO SILICEOUS MATERIAL
Scott, P.R. 1976.
U.S Patent 3,941,694

Cleanup, Beaches, Surfactants, Restoration

Treatment of siliceous material such as beach sand with a surfactant (made by blending a primary long chain alcohol with an aliphatic solvent) prevents oil from adhering to the material. If the surfactant is applied before oil contact, the sand will resist oil impregnation; if applied after contact, the surfactant displaces the oil and thereby cleans the sand.

[from Chemical Abstracts 85(2):#10078a, 1976]

C-1927-76
TECHNICAL CONSIDERATIONS AND RECOMMENDATIONS - OIL/WATER INTERFACE DETECTION AS APPLIED BY OCEAN SYSTEMS, INC.
Silvermetz, D. 1975.
Redesign, Fabrication and Test of a 1000 GPM High Seas Oil Recovery System, Appendix C. No. CG-D-182-75. 6p.

Detection, Design and engineering, Recovery, *Oil-water interface detector

A general description of an oil/water interface detector manufactured by National Sonics (NS) Corporation is given. Characteristics of NS sensors for interface detection, temperature effects, and suggestions are included.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4269. 1976]

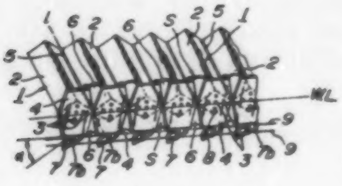
C-1928-76
OIL FENCE HAVING DIRECTIONAL CONTROL DEVICE
Tezuka, T., H. Kawakami, and K. Miura. 1976.
U.S. Patent 3,939,663

Recovery, Oil spills, Design and engineering

The oil fence, adapted to be positioned at an angle to its towing direction, collects or recovers pollutants from the water surface. It comprises a vertical plate, a float fixed to one side of the plate, a flexible connecting means attached to the vertical plate connecting vertical plates in a watertight manner, and directional control means attached to the vertical plate at an angle.

[from Selected Water Resources Abstracts 9(14):#W76-07441. 1976]

3,939,663
OIL FENCE HAVING DIRECTIONAL CONTROL DEVICE
Toshiyuki Tezuka; Hiroshi Kawakami, both of Kamakura, and Katsutoshi Miura, Yokohama, all of Japan, assignors to Bridgestone Tire Company, Ltd., Tokyo, Japan
Filed Sept. 27, 1974, Ser. No. 509,888
Claims priority, application Japan, Sept. 28, 1973, 48-112300[U]
Int. Cl.² E02B *15/04*
U.S. Cl. 61—1 F **4 Claims**



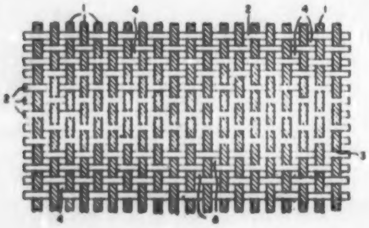
C-1929-76
OIL ADSORBENT
Tomikawa, M., A. Tsunoda, K. Kaneda, H. Ohkawa, and Y. Mugino. 1976.
U.S. Patent 3,960,722

Cleanup, Adsorption, Oil spills, Design and engineering

An oil adsorbent of plastic material which eliminates oils present on or in water is described. The adsorbent contains polyethylene and 30 to 80% by weight of an inorganic calcium compound.

[from Petroleum Abstracts 16(37):#224,751. 1976]

3,960,722
OIL ADSORBENT
Masami Tomikawa; Akiji Tsunoda; Kazuhisa Kaneda; Hideo Ohkawa, and Yutaka Mugino, all of Chiba, Japan, assignors to Idemitsu, Kosan Kabushiki Kaisha (Idemitsu Kosan Co., Ltd.), Japan
Continuation of Ser. No. 363,389, May 24, 1973, abandoned.
This application Jan. 27, 1975, Ser. No. 544,301
Int. Cl.^{2} C02B *9/02*
U.S. Cl. 210—36 **6 Claims**



C-1930-76
EVALUATION OF HERCULITE OIL RESISTANT FABRIC FOR COAST GUARD USE
U.S. Army Mobility Equipment Research and Development Center. 1975.
Redesign, Fabrication and Test of a 1000 GPM High Seas Oil Recovery System, Appendix C. No. CG-D-182-75. 9p.

Recovery, Oil spills, Design and engineering, *Oil resistant fabric

Samples of Herculite oil resistant coated fabric for use by the Coast Guard in a Weir Basin Oil Recovery System are evaluated. Test methods and results are given for each sample.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4270. 1976]

C-1931-76
NEW TWIST FOR OIL SPILL CLEANUP
Wambold, J.C., and C. Reed. 1976.
Mechanical Engineering 98(2):28-31.

Oil spills, Cleanup, Recovery, Skimmers, Design and engineering

The vee-boomed oil skimmer has been improved by adding a large driven paddle wheel which draws the slick into the area enclosed by the vee-boom. Once enclosed, the oil is directed to the sump, a submerged tray with a raised, rounded lip, where the oil and water are separated. The oil is then pumped to a barge for storage.

[from The Engineering Index Monthly 14(7):#049864. 1976]

C-1932-76
APPARATUS FOR THE COLLECTION OF BUOYANT FOREIGN MATTER
Waren, F.A.O. 1976.
U.S. Patent 3,928,206

Recovery, Containment, Oil spills, Design and engineering

A collecting tank consists of side walls, a rear wall, and an open bottom which is supported so as to allow it to float on water with its upper edge above the water level. Water flows into the tank by means of a vaned impeller which extends between the side walls and is arranged for rotation about an axis positioned above water level. Oil entering the collection tank is retained by means of a non-return valve arranged downstream of the impeller.

[from Selected Water Resources Abstracts 9(12):#W76-05534. 1976]

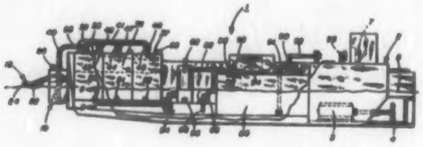
C-1933-76
INSTALLATION FOR REMOVING POLLUTANTS FROM WATERWAYS
Wickert, F.M. 1976.
U.S. Patent 3,957,646

Cleanup, Recovery, Oil spills, Skimmers, Design and engineering

An oil skimmer is equipped with a main operating vessel, a receiving tank, and a primary separation tank. The skimmer contains a large scoop which skims the water surface, collects the oil, and deposits it in the receiving tank.

[from Petroleum Abstracts 16(36):#224,530. 1976]

3,957,646
INSTALLATION FOR REMOVING POLLUTANTS FROM WATERWAYS
Forrest M. Wickert, 1224 Argyle Drive, North Madison, Ohio 44057
Filed Sept. 6, 1974, Ser. No. 503,729
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 S **34 Claims**



C-1934-76
POROUS MATERIALS FOR ABSORBING OILS FROM SPILLS
Yamamoto, M., K. Moriguchi, and H. Ohmori. 1976.
Japanese Kokai (unexamined patent application) 76 10,189

Cleanup, Oil spills, Absorption

An absorbent, porous material especially useful for removing oil spills is made by impregnating a porous material such as polyurethane foam with an inorganic powder and an oleophilic liquid polymer.

[from Chemical Abstracts 85(2):#10079b. 1976]

C-1935-76
PROGRAM FOR PREVENTING AND ELIMINATING OIL POLLUTION OF THE BUFFALO RIVER
Ziegler, R.C. 1976.
Final report, EPA/600/2-76/029. 136p.

Containment, Monitoring, Sampling, New York, *Oil pollutants, *Buffalo River

A summary of the work performed under a program for 'Prevention and Elimination of Oil Pollution of the Buffalo River' is reported. Various oil containment booms were designed and tested and an extensive sampling program was used to determine the distribution of oil pollutants. Oil in bulk water in sewers was monitored and oil trapping characteristics of inverted siphons were investigated.

[from Government Reports Announcements 76(8):#PB-249518/2GA. 1976]

3. RESTORATION

C-1936-76
SOILS CONTAMINATED BY OIL--REQUIREMENTS FOR RESTORATION AND RETURN TO PREVIOUS LAND USE OPTIONS
Yong, R. N., and B. P. Warkentin. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973.
D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 133-135.

Soil, Contamination, Oil Spills, Cleanup

The article discusses the need for restoration procedures for oil spill occurrences which produce no adverse residual oil and cleanup effects on the soil. Research must be conducted to determine how oil is held in soil and to find the most desirable methods for in-place removal and treatment.

[from Petroleum Abstracts 16(28):#221, 981. 1976]

4. OIL TRANSFER AND TRANSPORT

C-1937-76
AMLWCH SINGLE BUOY MOORING
Anon. 1976.
Marine Pollution Bulletin 7(4):62.

Oil transfer, Tankers, Oil spills, Leakage, *Single buoy mooring

The siting of the world's largest single buoy mooring (SBM) at Amlwch on the Island of Anglesey has been widely protested because of possible oil spill dangers. Critics claim that SBM's are particularly prone to accidental discharges of oil. The SBM is sited 4 km off the coast and is expected to handle tankers with up to 500,000 ton capacities.

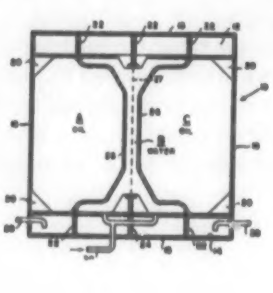
C-1938-76
CARGO/BALLAST SEPARATION BY DUAL MEMBRANE SYSTEM
Anon. 1976.
US. Patent 3,943,873

Oil-water separation, Ballast, Ships, Oil tanks, Design and engineering

"A ship ballasting system separating the oil cargo and the water ballast sections comprising, a closed oil tank having an overhead structure, bulkheads and a bottom and a liquid cargo connection communicating with the oil cargo sections of the tank."

[from Underwater Information Bulletin 8(4):48. 1976]

3,943,873
CARGO/BALLAST SEPARATION BY DUAL MEMBRANE SYSTEM
Frederic S. Hering, Chesapeake, Va., and Joseph I. Schwartz, Ellicott City, Md., assignors to The United States of America as represented by the Secretary of the Navy, Washington, D.C.
Filed Mar. 18, 1974, Ser. No. 452,082
Int. Cl.^{2} B63B *25/12*
U.S. Cl. 114—125 **3 Claims**



C-1939-76
LYME BAY OIL POLLUTION
Anon. 1976.
Marine Pollution Bulletin 7(4):62.

Oil transfer, Tankers, England, Oil spills, Pollution prevention, Cleanup

Lyme Bay, off the Devon/Dorset coast, has been used in recent years as a point for transferring oil from supertankers to smaller vessels and frequent oil spillage has resulted from the operations. Shell International Marine has provided a converted fishing boat, a crew, and equipment to prevent and clean up oil spills in the bay and beach areas.

C-1940-76
SCOTTISH PLANT WOULD USE UNDERGROUND STORAGE
Anon. 1975.
Oil and Gas Journal 73(36):45.

Storage, Crude oil, Refineries, Environmental effects, Scotland, *Underground storage

Cromarty Petroleum Company is seeking permission to build a 32 million l/d (200,000 b/d) refinery on the Cromarty Firth. The company is investigating the use of underground caverns for storage of the oil as a means of minimizing environmental impacts. The caverns are estimated to have a storage capacity of 3.2 billion liters (20 million barrels).

[from International Petroleum Abstracts 4(1):#107. 1976]

C-1941-76
STORAGE OF HYDROCARBONS IN CAVERNS [English summary]
Beissner, K., W. Dreyer, G. Fürer, R. Koch, and H. Schleicher. 1976.
Erdöhl und Kohle 29(5):193-198.

Storage, Hydrocarbons, Pollution prevention, Regulations, *Underground caverns

For reasons of environmental protection, public safety, and regional planning, the establishment of governmental regulations for underground storage of hydrocarbons in caverns is urged. Environmental legislation is needed to prevent contamination of groundwater by oil, to protect rivers and sea from the disposal of salt brines, and to protect against shifting of the ground above such storage facilities.

C-1942-76
PIPELINES, OIL SPILLS, GAS PLANTS AND THE ALBERTA ENVIRONMENT
Cook, F.D., W.B. McGill, M. Nyborg, and J.A. Toogood. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p. 47-50.

Oil spills, Pipelines, Environmental effects, Soil, Restoration, Canada

Extensive research was conducted by the Soil Science Department to measure the environmental effects of sulfur emissions from gas processing plants, oil spills resulting from pipeline breaks, and pipeline installations across cultivated fields in Alberta. Field studies to study reclamation procedures on oil contaminated soils were begun in the Edmonton areas.

[from Petroleum Abstracts 16(28):#221,955. 1976]

C-1943-76
OIL TANKER POLLUTION CONTROL: DESIGN CRITERIA VS EFFECTIVE LIABILITY ASSESSMENT
Cummins, P.A. 1975.
Journal of Maritime Law and Commerce 7(1):169 -206.

Pollution prevention, Tankers, Economics, Design and engineering, Segregated ballast, Load-on-top

The annual costs of adopting single-skin and double-skin segregated ballast design criteria were calculated for the U.S. and the world in 1980. Universal acceptance of single-skin segregated ballast criteria would add an estimated $54-125 million to the world freight bill, and double skin would add $153-358 million in 1980. The benefits of the Load-on-Top method and segregated ballast method are compared.

[from Oceanic Abstracts 13(3):#76-02973. 1976]

C-1944-76
GROUNDWATER POLLUTION FROM SUBSURFACE EXCAVATIONS. PART 11. TANK AND PIPELINE LEAKAGE
Environmental Protection Agency. 1975.
Water Well Journal 24(2):37-41.

Pipelines,Oil Tanks, Leakage, Groundwater, Pollution prevention

Pollution control methods used in the occurrence of tank and pipeline leaks are reviewed with emphasis on transfer and storage of petroleum products. The single greatest case of leakage is corrosion, followed by personnel, material or equipment failure or malfunction. Additional causes are accidental rupture by earth moving equipment, vandalism, earthquakes, severe weather, fires, and lightning.

[from Petroleum Abstracts 16(21):#219,850. 1976]

C-1945-76
TRANSPORT PROBLEMS OF PETROCHEMICALS. A SHIPBUILDER'S COMMENTS ON SOME RECENT SAFETY REGULATIONS
Haddeland, T. 1975.
Shipping World and Shipbuilder 168(3907):629-631.

Oil transport, Petrochemicals, Regulations

General IMCO recommendations for the marine shipment of bulk chemicals are outlined; three degrees of physical protection are specified. Types of tank coatings to prevent corrosion and the contractual risks posed by changes or additions to shipping regulations are also presented.

[from Environmental Health and Pollution Control 9(5):#1276. 1976]

C-1946-76
ECOLOGICAL INVESTIGATIONS OF ALASKAN NORTH SLOPE OIL DEVELOPMENT
Hanson, W.C., and L.E. Eberhardt. 1976.
Biomedical and Environmental Research Program of the LASL Health Division, Progress report LA-6464-PR. ERDA Contract W-7405-ENG. 36. p. 32-33.

Pipelines, Alaska, Environmental effects, Exploration, Oil transport, *Indicator organisms, *Arctic fox

The study objective is to evaluate the ecological consequences of the construction and operation of the Trans-Alaska pipeline by means of selecting indicator organisms from tundra environments in the vicinity of lands disturbed by exploration, extraction, and transport of North Slope petroleum. Arctic and red fox populations were selected for study. During the past year, 26 arctic fox dens were located in the Prudhoe Bay area, of which 11 were actively used by 9 fox families. An additional 30 arctic and red fox dens were found along a 40 mile segment of the pipeline route. Live-trapping operations resulted in the tagging of 42 foxes. In addition, prey populations of lemmings and shoreline birds are being mapped and counted to determine interactions of the foxes and their alternative food resources. Biological studies on foxes resulted in a large amount of data on arctic and red fox ranges, denning habits, behavior, food habits, etc. that are now being summarized.

C-1947-76
SOPHISTICATED ANTI-POLLUTION SYSTEM FOR DUBAI DRY DOCK BEING BUILT BY UK FIRM
Jones, B. 1976.
Petroleum Times 80(2026):21-22,31.

Pollution prevention, Tankers, Ships, Oil-water separation, Bilges, Ballast, *Dubai dry dock

One of the largest dry dock and ship repair complexes in the world is under construction at Dubai. The complex will include a sophisticated array of oil pollution prevention systems including a tank cleaning facility and an oily-water separator system for processing all bilge and ballast waters before discharge to the sea.

[from Petroleum Abstracts 16(32):#223,469. 1976]

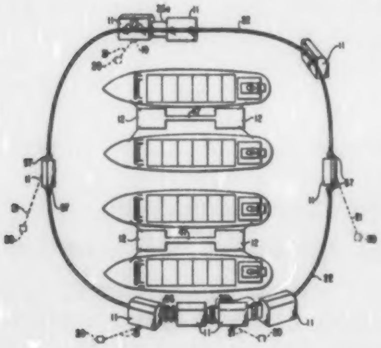
C-1948-76
DEEP SEA TANK AND SEAPORT SYSTEM
Memoli, S.J. 1976.
U.S. Patent 3,958,521

Oil transfer, Tankers, Containment, Oil spills

A deep sea tank and seaport system is described for docking and oil transfer by tankers. The system can also be employed around oil drilling rigs and other marine environments to contain oil spills.

[from Petroleum Abstracts 16(33):#223,742. 1976]

3,958,521
DEEP SEA TANK AND SEAPORT SYSTEM
Steven J. Memoli, Box 720 N. Vosseller Ave., Martinsville, N.J. 08836
Filed May 30, 1975, Ser. No. 582,091
Int. Cl.^{2} B63B *25/08, 35/32*
U.S. Cl. 114—.5 T **9 Claims**



C-1949-76
ANALYSIS OF RELATIVE POLLUTION RISK AND ECONOMICS OF SHIP VERSUS PIPELINE TRANSPORT OF OCS OIL TO ONSHORE TERMINALS
Owen, J.J.,III, L.J. Donovan, and D.W. Weiss. 1976.
Offshore Technology Conference, 8th, Houston, 1976. Preprint No. OTC-2715. Vol. 3. p. 1091-1104.

Statistical analysis, Oil transport, Pipelines, Tankers, OCS, *Onshore terminal

A risk and cost comparison methodology is developed which combines available cost and spill risk data into a format that is useful in rational decision making regarding ship vs. pipeline transport of OCS oil to onshore terminals.

[from Petroleum Abstracts 16(25):#221,061. 1976]

C-1950-76
OIL TANKER INDUSTRY FOUNDERING NEAR ROCKS
Sayre, R. 1976.
Audubon 78(4):141-142.

Tankers, Oil discharges, Pollution prevention, Segregated ballast

The article reviews a number of recent oil tanker and supertanker accidents and comments on the economically troubled state of the world's tanker industry. A recently proposed plan which would drastically cut oil pollution of the sea by tankers and at the same time reduce the present enormous tanker surpluses is outlined. The plan calls for retrofitting existing vessels with segregated ballast tanks which would eliminate the annual dumping of up to three million tons of oil into the world's waters.

C-1951-76
SPORT FISHING IN WESTERN DELAWARE BAY: ASSESSMENT OF CRITICAL AREAS
Smith, R.W. 1975.
University of Delaware, Final report no. CMS-RANN-2-75. 22p.

Oil transport, Ships, Refineries, Delaware Bay, *Sport fishing

Because marine sport fishing greatly contributes to the economy and recreation of the Delaware Bay region, a study of fish distributions and densities was conducted to find suitable locations for ship anchorage which would not impair sport fishing. This study was conducted as a part of Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation.

C-1952-76
UNDERGROUND FUEL STORAGE
Weeks, J.P., and R. Smith. 1975.
Petroleum Review 29(347):767-773.

Storage, Crude oil, Economics, *Underground storage, *Surface tanks

The advantages as well as limitations of underground storage facilities for crude oil from offshore production sources are discussed including both natural and manmade facilities. Pollution problems, adequate site investigation, and multi-product storage are considered. A cost comparison between surface tank farms and excavated underground storage indicates advantages, primarily in operating costs, of the latter.

[from International Petroleum Abstracts 4(2):#403. 1976]

C-1953-76
MARINE POLLUTANT TRANSFER
Windom, H.L., and R.A. Duce (eds.). 1976.
Lexington, Mass., D.C. Heath and Company, 1976.

Oil transfer, Fate, Hydrocarbons, Weathering, Physical effects

The book contains 14 chapters all concerned with the transfer of various pollutants (including petroleum hydrocarbons) across the primary interfaces between the ocean and other environments. Petroleum-related chapters are: Chapter 7, The Flux of Light Hydrocarbons into the Gulf of Mexico via Runoff; Chapter 8, Transfer of Petroleum Residues from Sea to Air: Evaporative Weathering; Chapter 9, Transfer of Particulate Hydrocarbon Material from the Ocean Surface to the Water Column; Chapter 10, Transfer of Petroleum and Biogenic Hydrocarbons in the Sargassum Community; and Chapter 12, High Molecular Weight Hydrocarbons in the Air and Sea: Rates and Mechanisms of Air/Sea Transfer.

C-1954-76
SEA-SURFACE DRIFT CURRENTS
Wu, J. 1975.
Offshore Technology Conference, 7th, 1975. Paper No. OTC 2294. 8p.

Oil spills, Drift, Dispersions, *Sea-surface drift currents

In studies of wind and wave-induced surface drift currents at various fetches, the ratio between the wind-induced drift and the wind velocity was found to decrease with the increasing fetch, while the ratio between the wave-induced drift and the wind velocity was found to increase with the fetch. The total surface drift is almost independent of the wind fetch and is about 3.5% of the wind velocity at long fetches. This work is a part of the project, Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation.

5. WASTE TREATMENT AND DISPOSAL METHODS

C-1955-76
AIR OXIDATION OF SOUR WATER
Inventor unknown. 1975.
French patent 59,711u/40

Refineries, Wastewater treatment, Oxidation, pH control

An air oxidation process useful for treating sour petroleum refinery wastewaters containing sulfides and other anions is described. The process basically includes pH adjustment to 6-13 followed by heating and oxidation.

[from Selected Water Resources 9(11):#W76-05127. 1976]

C-1956-76
EFFLUENTS CONCENTRATION
Inventor unknown. 1974.
Soviet patent 402,517

Wastewater treatment, Waste oil, Evaporation

A method for the concentration of effluents from petroleum treatment plants has been patented. The process involves multi-stage evporation using an inert, solid heat transfer agent such as metal shot of granite chips.

[from Selected Water Resources Abstracts 9(9):#W76-04061. 1976]

C-1957-76
GRANULAR MEDIA FILTRATION OF PETROLEUM REFINERY EFFLUENT WATERS
Author unknown. 1975.
Washingtion, D.C., American Petroleum Institute, 1975. 33p.

Wastewater treatment, Refineries, Filtration

Summary not available.

[from Environment Abstracts 6(6):82. 1976]

C-1958-76
PETROLEUM AND OIL WASTE DEGRADATION
Inventor unknown. 1976.
Belgium patent 832,298

Wastewater treatment, Biodegradation, Filtration

In the method proposed, an aqueous mixture of the effluent and a microorganism along with necessary nutrients are introduced into an aerated degradation system. The mixture is then passed to a second degradation system where a different microorganism is added. Several tanks may be employed in each degradation stage, and filtration may be performed after each stage.

[from Selected Water Resources Abstracts 9(14):#W76-06975. 1976]

C-1959-76
REMOVING PETROLEUM PRODUCTS FROM EFFLUENT WATER
Inventor Unknown. 1976.
Soviet Patent 466,029

Wastewater treatment, Oil-water separation, Filtration, Coalescence

In the title method, mechanical impurities in the effluent are removed on a vibrating sheet filter. The effluent is further cleaned by passing through a series of filter elements fitted with drainage pipes. Wastewater is fed into a section of the filter which contains floating polyethylene pieces. After complete saturation, the petroleum droplets begin to coalesce and pass downward into a storage tank. Oil can then be withdrawn for reuse.

[from Selected Water Resources Abstracts 9(14):#W76-06976. 1976]

C-1960-76
METHOD OF BREAKING DOWN EMULSIONS
Aliev, V.S., N.B. Altman, P.P. Galonsky, A.D. Guterman, L.V. Malina, et al. 1976.
U.S. Patent 3,950,245

Waste oil treatment, Emulsions, Oxidation, *Demulsification

A method for demulsifying oil emulsions is described. The method consists basically of heating the oil emulsion between 40°C and 70°C and then bubbling specified quantities of air through the heated emulsion until natural oil emulsifiers are oxidized and total breakdown occurs.

[from Petroleum Abstracts 16(31):#222,872. 1976]

C-1961-76
APPARATUS FOR SEPARATING SOLIDS AND WATER FROM USED OIL SLUDGES
Alva Laval Industrietechnik G.m.b.H. 1976.
German Offenlegungsschriften (unexamined patent application) 2,438,602

Waste oil treatment, Oil-water separation, Sludge

A process and apparatus are described which separate used oil from solids and water. The process involves preheating, sedimentation, drying, and repeated centrifuging; the equipment includes heat exchangers, buffer tanks, pumps, and a screen.

[from Chemical Abstracts 85(4):#23477e. 1976]

C-1962-76
BIG REFINERY HAS ADVANCED WATER TREATMENT UNIT
Anon. 1975.
Oil and Gas Journal 73(50):82-83.

Wastewater treatment, Refineries, Canada, Water quality

The refinery effluent-water quality control system of the Amoco Oil Company 54.7 million l/d (334,000 b/d) refinery at Texas City, Texas, is outlined. The facilities include storage for storm flow up to 310.4 million l (82 million gals), emergency chemical spills basin, API separators for primary treatment, staged equalization, pH control, preaeration, chemical destabilization, filtration, activated sludge for secondary treatment, and tertiary treatment involving filtration.

[from Selected Water Resources Abstracts 9(9):#W76-04024. 1976]

C-1963-76
DISPOSAL OF LIQUID WASTE BY POWELL DUFFRYN PROCESS
Anon. 1974.
Chemistry and Industry No. 1:3.

Wastewater disposal, Waste oil, Oil industry

The article describes the "Chemfix" process which treats industrial liquid waste with chemical reagents and discharges it to form solid material suitable for landfilling. The process is applicable to wastes produced by chemical oil and petroleum, mining, textiles and metal production, and treatment industries.

[from Selected Water Resources Abstracts 9(9):#W76-04188. 1976]

C-1964-76
ENVIRONMENTAL MANAGEMENT
Anon. 1975.
Hydrocarbon Processing 54(10):73-111.

Refineries, Wastewater treatment, Environmental management, Economics

This report consists of six papers dealing with environmental aspects of effective wastewater treatment, recycling, and reuse of waste products, and the economics and economic impacts of environmental cleanup legislation. One paper dealing primarily with refinery effluents entitled, 'Incinerate refinery waste in a fluid bed', by K.P. Becker and C.J. Wall, is part of the report.

[from International Petroleum Abstracts 4(2):#591. 1976]

C-1965-76
MAPCO PROCESS CONTROLS - POLLUTION CONTROLS (product information)
Anon.
Mapco, Inc., Process and Pollution Controls Division, 1437 S. Boulder Ave., Tulsa, OK 74119.

Wastewater treatment, Oil-water separation, Coalescence, Skimmers

The booklet describes the company's line of pollution control products which includes the CATA-SEP series of oil-water separators. The CATA-SEP products range from single-vessel oil coalescing units to complex oil coalescing and gravity separation systems for shipboard and land-based applications. Capacities range up to about 5600 liters per minute (1500 gallons per minute). A pontoon-mounted oil skimmer unit, the CATA-SEP skimtrol, is also featured.

C-1966-76
MARINE SEPARATORS (product information)
Anon.
De Laval Separator Company, Poughkeepsie, NY 12602.

Oil-water separation, Fuel oil, Sludge, Ships

The brochure describes a line of centrifugal separators for removing water and/or sludge from fuel oil and other mineral oils in shipboard applications. Several models useful for either purification or clarification are described.

C-1967-76
NEW WASTEWATER SYSTEM TREATS OIL AT EATON AXLE (news brief)
Anon. 1976.
Pollution Engineering 8(7):16.

Wastewater treatment, Oil-water separation, Sludge

Eaton Corp's wastewater treatment system is designed to remove oil from wastewater by chemical processing coupled with dissolved air flotation. In a clarifier tank the oil sludge is skimmed off and the treated effluent is released into the general sewage system. Oil content is reduced from 10,000 mg/l to less than 100 mg/l. FFI contact Eaton Corp., Manufacturing Services Center, Cleveland, OH.

C-1968-76
OIL EMULSION BREAKER (product information)
Anon. 1976.
Pollution Engineering 8(6):50.

Oil-water separation, Emulsions, *Sepol 433

Sepol 433 separates oil from oil-water emulsions with no need for a prime coagulant. It is designed to increase the efficiency of gravity or mechanical oil separation in air flotation units, wet cyclones and centrifuges. FFI contact Dearborn Chemical (U.S.) Chemed Corporation.

C-1969-76
RAINBEAUX OIL/WATER SEPARATORS (product information)
Anon.
Oil Mop Inc., Post Office Box P, Belle Chasse, LA 70037

Wastewater treatment, Design and engineering, Oil-water separation, Ships, Refineries

Several brochures describe the Rainbeaux R-10 and R-50 oil/water separator systems which are designed not only for cleaning up shipboard bilge and ballast waters, but also for land-based industrial effluents such as oil refinery and petrochemical wastewaters. The units have a capacity rating of up to 10 and 50 gals/minute (38 and 190 liters/minute) respectively, and both routinely discharge effluents with less than 5-10 ppm of oil.

C-1970-76
UNDERWATER SEDIMENT REMOVED WITH MINIMUM TURBIDITY
Anon. 1975.
Water and Pollution Control 113(11):9.

Wastewater treatment, Sediments, Cleanup, Oil industry

The Mud-Cat, a machine developed to clean sediment from the bottoms of municipal reservoirs and industrial settling ponds, is a self-propelled barge fitted with an eight-foot wide horizontal auger mounted on a hydraulically operated boom. The machine can remove from 40-90 m^3 (50-120 yd^3) of sediment and industrial waste per hour. It has been used by the oil industry, for an irrigation reservoir, for removing paper fiber wastes, and for cleaning sludge and coal slurries in the United States and Canada.

[from Selected Water Resources Abstracts 9(14):#W76-07040. 1976]

C-1971-76
TREATING EMULSIFIED WASTE WATERS CONTAINING METALS AND OILS
Ariyama, K., and T. Kurokawa. 1975.
Japanese Kokai (unexamined patent application) 75,159,148.

Wastewater treatment, Oil-water separation, Flocculation

"A metals-containing oil-water emulsified wastewater is adjusted to pH < 6.5 in the presence of tannin or bisphenol-A, a chelating agent, a reducing agent, and a metal collector such as a sulfide. The wastewater is then flocculated with an organic flocculant to remove oils and metals simultaneously and effectively."

[from Chemical Abstracts 84(26):#184640x. 1976]

C-1972-76
ULTRAFILTRATION OF OILY WASTES FROM PROCESS INDUSTRIES
Bansal, I.K. 1975.
Annual Meeting of the AIChe Conference, 68th, Los Angeles, 1975. 23p.

Waste oil treatment, Industries, Filtration

The UCARSEP ultrafiltration process which uses an inorganic membrane is described and its use in treating various oily waste feeds is elaborated. Performance details are given.

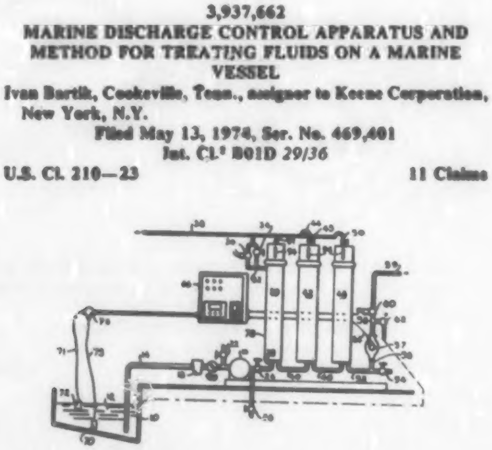
[from Industrial Wastes Information Bulletin 6(6):#HMS 6260. 1976]

C-1973-76
MARINE DISCHARGE CONTROL APPARATUS AND METHOD FOR TREATING FLUIDS ON A MARINE VESSEL.
Bartik, I. 1976.
U.S. Patent 3,937,662

Oil-water separation, Bilge, Ballast, Filtration, Coalescence, Design and engineering

Oily bilges and ballast waters are treated by passing them through filtering and coalescing devices which separate the oil from the water. The oil is stored and the water is discharged overboard. The purity of the discharged water is continuously monitored by a turbidity meter, and the flow rate is controlled to meet all pollution standards.

[from Chemical Abstracts 84(26):184627y. 1976]



3,937,662
MARINE DISCHARGE CONTROL APPARATUS AND METHOD FOR TREATING FLUIDS ON A MARINE VESSEL
Ivan Bartik, Cookeville, Tenn., assignor to Keene Corporation, New York, N.Y.
Filed May 13, 1974, Ser. No. 469,401
Int. Cl.^{2} B01D 29/36
U.S. Cl. 210—23 11 Claims

C-1974-76
PREVENTION OF WATER POLLUTION IN THE PETROCHEMICAL INDUSTRY
Bendetti, L., et al. 1975.
Industrial Waste Water and Wastes - II. B. Goransson (ed.). Int. Congress on Industrial Waste Water and Wastes, 11th, Stockholm, Sweden, 1975. [Pure and Applied Chemistry 45(3,4).]

Pollution prevention, Wastewater treatment, Industries, Petrochemicals

Summary not available.

[from Water Research 10(7):309. 1976]

C-1975-76
ANALYSIS OF INDUSTRIAL WASTE WATERS [in French]
Bormans, J.(ed.). 1974.
Liege, Belgium, Editors CEBEDOC, 1974. 186p.

Wastewaters, Refineries, Sampling, Chemical analysis

Papers on the analysis of industrial wastewaters are reprinted including a paper on the sampling of refinery liquid effluents.

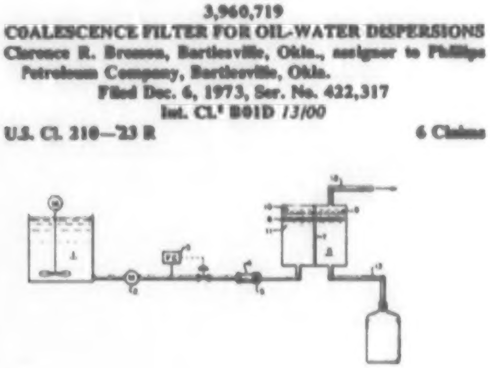
[from WRC Information 3(12):#76-902S. 1976]

C-1976-76
COALESCENCE FILTER FOR OIL-WATER DISPERSIONS
Bresson, C.R. 1976.
U.S. Patent 3,960,719

Dispersions, Oil-water separation, Coalescence, Ballast, Bilges, Tankers

A filtering medium is used for coalescing oil dispersed in water to facilitate sea separation of oil droplets. The filter is composed of an oleophilic fiber-forming polymer and can be used to treat bilge and ballast waters from tankers.

[from Petroleum Abstracts 16(35):#224,218. 1976]



3,960,719
COALESCENCE FILTER FOR OIL-WATER DISPERSIONS
Clarence R. Bresson, Bartlesville, Okla., assignor to Phillips Petroleum Company, Bartlesville, Okla.
Filed Dec. 6, 1973, Ser. No. 422,317
Int. Cl.^{2} B01D 13/00
U.S. Cl. 210—23 R 6 Claims

C-1977-76
PROCESS FOR THE SEPARATION OF MIXTURES OF OIL, WATER AND SOLIDS
Busch, F. 1975.
German Patent 2,507,271

Wastewater treatment, Oil-water separation, Reclamation

A process is described for separating and reclaiming pure oil from a mixture of oily water and solids. The process includes adjustment of the water content to 45-80% of the mixture, heating to above 80°C, admixture of specified amounts of an alkaline silicate solution, and boiling for 1.5 to 2 hours. The resultant supernatant oily phase is separated from the lower muddy phase and additionally treated for purification of the oil.

[from Petroleum Abstracts 16(23):#220,422. 1976]

C-1978-76
OIL/WATER SEPARATION: A NEW DEVELOPMENT
Chambers, D.B. 1975.
Water and Waste Treatment 18(7):24-25.

Wastewater treatment, Oil-water separation, Coalescence

The article describes a new process of oil coalescence in which the oil concentration in mixtures may be reduced to very low levels. The oily water is passed through an open pored material under low pressure and coalescence occurs, forming large oil droplets which rise to the water surface. Oil is removed by skimming, scraping or by using floating arm takeoff units.

[from Environmental Health and Pollution Control 9(5):#1339. 1976]

C-1979-76
METHOD AND APPARATUS FOR SEPARATING OIL FROM AQUEOUS LIQUIDS
Chapman, W.F. 1976.
U.S. Patent 3,948,786

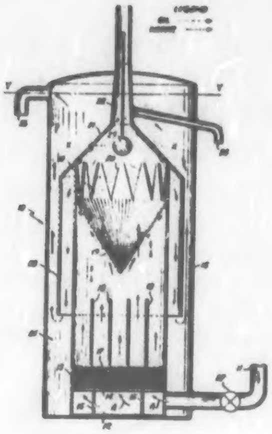
Wastewaters, Oil-water separation, Coalescence

Fine oily particles are separated from aqueous liquid at very high flow velocities by passing the oil-bearing liquid upward through a column packed with oleophilic granules. The flow velocity lifts and disperses the granules, and their movement causes the coalescence and collection of the fine oily particles. Coalesced, large drops of oil are released back into the stream and then intercepted and extracted by steeply inclined screens. They then flow into a storage facility.

[from Petroleum Abstracts 16(31):#222,875. 1976]

(patent illustration on the following page)

3,948,768
METHOD AND APPARATUS FOR SEPARATING OIL FROM AQUEOUS LIQUIDS
Willis F. Chapman, 6511 Jay Miller Drive, Falls Church, Va. 22041
Continuation-in-part of Ser. No. 440,093, Feb. 6, 1974. This application July 7, 1975, Ser. No. 591,841
Int. Cl.² B01D *13/00*
U.S. Cl. 210—20 **11 Claims**



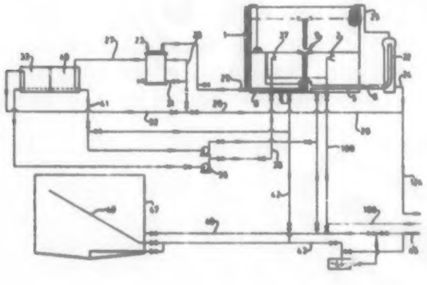
C-1980-76
LIQUID SEPARATION EQUIPMENT
Cheysson, P.J., P.J. Verney, and M.A. Coquard. 1975.
U.S. Patent 3,925,204

Wastewater treatment, Ballast, Tankers, Oil-water separation

A method for partially separating liquids of different densities, i.e. oily water discharged from tankers, is described. The mixtures are passed into a tank beneath the surface of a layer of liquid in the tank. The top layer of liquid is skimmed off by means of a weir. Heavier liquid is withdrawn at the bottom of the liquid layer and discharged. Additional oil-water separation cycles separate the skimmed layer and the heavier of this liquid is recycled back to the tank for future treatments.

[from Selected Water Resources Abstracts 9(10):#W76-04614. 1976]

3,925,204
LIQUID SEPARATING EQUIPMENT
Philippe Jean-Marie Cheysson, Sainte Adresse; Paul Jean Verney, and Michel Alain Coquard, both of Le Havre, all of France, assignors to Exxon Research & Engineering Company, Linden, N.J.
Filed Mar. 29, 1973, Ser. No. 346,056
Claims priority, application France, Mar. 30, 1972, 72.11324
Int. Cl.² B01D *17/02*
U.S. Cl. 210—73 **17 Claims**



C-1981-76
COALESCENCE OF EMULSIFIED OILY WASTES BY FIBROUS BED
Chieu, J.N. 1975.
Ph.D. Thesis. University of Texas. 213p.

Wastewater treatment, Oil-water separation, Coalescence, Emulsions

The feasibility of using a fibrous bed coalescer to separate emulsified oil from industrial waste streams and to evaluate system parameters was determined. Several types of coalescing media were used and four types of oily wastes were tested to determine the effect of fluid properties. Contact angle, interfacial tension, and oil viscosity were measured for each system and the results were compared with the coalescer efficiency.

[from Petroleum Abstracts 16(25):#221,087. 1976]

C-1982-76
PURIFICATION OF WATER CONTAMINATED WITH HYDROCARBONS
Compagnie Francaise de Raffinage. 1975.
French Demande 2,251,525

Wastewater treatment, Contaminants, Hydrocarbons

By impregnating powdered rubber with organic solvents such as Decalin, Bu_2O, MeCOEt, BuCl, heptane, or CCl_4, the powder effectively removes residual hydrocarbons from water. In an example of this process, the hydrocarbon content of water was reduced from 500 ppm to 1 ppm.

[from Chemical Abstracts 85(4):#25136s. 1976]

C-1983-76
DESIGN AND EVALUATION OF AN OILY WASTES DISPOSAL SYSTEM FOR RED RIVER ARMY DEPOT
Crouse, R.W.,Jr. 1976.
Final report, DARCOM-ITC-02-08-76-003. 97p.

Waste oil disposal, Oil-water separation, Design and engineering, Wastewater treatment

Oily waste samples were taken from various drainage ditches throughout the Red River Army Depot (RRAD). Analysis indicated that the effluent leaving RRAD contained 12 ppm oil. Since this result did not meet effluent requirements of the Environmental Protection Agency, an oily waste disposal system was designed using a lagoon for oil separation and boilers for oil disposal.

[from Government Reports Announcements 76(14):#AD-A024729/6GA. 1976]

C-1984-76
CONTINUOUS RADIAL FILTRATION IN THE PURIFICATION OF OILY WATER
Fasoli, U., R Conti, and G. Genon. 1976.
Water Research 10(7):633-635.

Wastewater treatment, Oil-water separation, Filtration

This paper examines the possibility of using radial filtering in the separation of oil suspended in water with a new type of continous sand filtering apparatus. Results seem to demonstrate that continuous radial filtration offers an encouraging means for the treatment of oil-polluted water.

C-1985-76
ACTIVATED CARBON BY PYROLYSIS OF ORGANIC SLUDGES
Fasoli, U., and G. Genon. 1976.
Water Research 10(6):545-547.

Wastewater treatment, Refineries, Sludge

Refinery wastes and those from a biochemical industry were carbonized so as to obtain active carbon for the treatment of the wastewaters. It was concluded that active carbon obtained from organic sludges may be used to purify the wastes themselves. Savings in this process appear to be possible if active carbon could be made economically from these wastes.

C-1986-76
DEEP MYSTERY. NOW WHERE DID THAT STUFF GO. . .
Forrestal, L. 1975.
Environment 17(8):25-31.

Disposal, *Oilfield brines, *Deep well injection

Details are presented on current practices of deep well injection of radioactive wastes, sewage effluents, and oilfield brines. Deep well construction requirements are described in respect to characteristic injection rate, injection pressure and injection capacity of each well, and factors to determine the safety requirements for a deep well system.

[from Environmental Health and Pollution Control 10(1):#162. 1976]

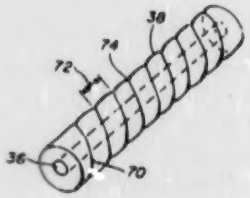
C-1987-76
REINFORCED COALESCING CELL
Fowler, L.L. 1976.
U.S. Patent 3,931,019

Wastewater treatment, Oil-water separation, Emulsions, Coalescence

A cell is described for coalescing oil droplets from aqueous emulsions. The cell consists of an emulsion-breaking fiber core through which the emulsion is forced, and a wire wound helically around the exterior surface of the fibrous material.

[from Chemical Abstracts 84(26):#184599r. 1976]

3,931,019
REINFORCED COALESCING CELL
Leslie L. Fowler, Tulsa, Okla., assignor to Products and Pollution Controls Co., Tulsa, Okla.
Continuation-in-part of Ser. No. 408,458, Oct. 23, 1073, abandoned. This application Feb. 18, 1975, Ser. No. 550,188
Int. Cl.^{2} B01D *25/22*
U.S. Cl. 210—485 **3 Claims**



C-1988-76
SUBSURFACE BRINE DISPOSAL - BE REASONABLE
Fryberger, J.S. 1976.
Ground Water 14(3):150-156.

Groundwater, Contamination, Wastewater disposal, Oil industry, Oklahoma

The battle between landowners in Texas County, Oklahoma, desiring to protect their fresh groundwater from pollution, and oil companies needing a disposal zone for injection of oil-field brines is reported. Results of a complete hydrogeologic analysis of the area are presented.

[from Petroleum Abstracts 16(28):#221,908. 1976]

C-1989-76
LIQUID WASTE TREATMENT FOR THE PETROLEUM REFINING INDUSTRY [in Japanese]
Fujimori, K. and F. Sato. 1974.
Nenryo Oyobi Nensho 41(7):635-640.

Waste oil treatment, Wastewater treatment, Oil-water separation, Refineries, Japan

Current refinery wastewater treatment methods of the Mizushima Refinery in Japan are detailed. Oily wastewater is first treated in an API separator and after pH adjustment the remaining liquid is fed into an activated sludge system, followed by clarification and aeration. Oily emulsions from the API separator are recovered by centrifugation.

[from Selected Water Resources Abstracts 9(15):#W76-07537. 1976]

C-1990-76
SORPTION METHOD FOR THE PURIFICATION OF PETROLEUM CONTAINING WASTE WATERS [in Russian]
Garibov, I.M., A.A. Mamedov, and S.A. Efendieva. 1975.
Azerbaydzhanskiy Khimicheskiy Zhurnal No. 3:75-76.

Wastewater treatment, Adsorption, *Activated carbon

The adsorption of petroleum and its derivatives in wastewaters by different solid sorbents was studied. Activated carbon, especially type AG-5, was found to have the highest adsorption capacity for petroleum and petroleum products. Aluminum and iron hydroxide showed negligible adsorption capacity for petroleum.

[from Selected Water Resources Abstracts 9(11):#W76-05491. 1976]

C-1991-76
TREATMENT OF OILY WASTES FROM SHIPS
Gillespie, R.J., and C.R. Phillips. 1976.
Marine Technology Society Journal 10(5):19-26.

Oil-water separation, Wastewaters, Ships, Design and engineering

The available principles for oil-water separator design were evaluated and one method was further developed. The design was prepared for the treatment of a shipboard effluent containing one ton/hour of oil waste to produce an effluent containing less than 15 mg/l of oil in water.

C-1992-76
INCINERATORS
Grannec, R.Y-M. 1975.
British Patent 1,385,782

Waste oil disposal, Petrochemicals, Incineration

Volatile wastes, including petrochemical and oil wastes can incinerated in an open top combustion chamber. Combustion control is achieved by air and/or water injection, and rich and poor calorific valve wastes are treated simultaneously.

[from Industrial Wastes Information Bulletin 6(5):#HMS 6112. 1976]

C-1993-76
OPTIMIZE THE EFFLUENT SYSTEM
Grutsch, J.F., and R.C. Mallatt. 1976.
Hydrocarbon Processing 55(3):105-112.

Refineries, Wastewater treatment, Activated sludge, Guidelines

Refinery effluent water quality can be significantly improved and capital and operating costs can be lowered by carefully controlling and integrating the separate elements of a wastewater treatment system. This article, which discusses the activated sludge process, is the first of a series that outlines key objectives and recommends treatment sequences for optimizing refinery wastewater treatment systems.

C-1994-76
SIX YEAR GERMAN WASTE OIL EXPERIENCE
Haberland, B. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.27-39.

Waste oil treatment, Recovery, Disposal, Legislation, Germany, West

The paper describes the successful operation of the 1968 German Waste Oil Law which makes users pay a levy which is paid to collectors, refiners, and incinerator operators to meet the costs of recovery and disposal.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6336. 1976]

C-1995-76
COMPOSITION FOR REMOVAL OF ORGANIC MATERIALS FROM WATER
Harris, A., W. Margotte, and B.M. Thomas. 1976.
British Patent 1,420,394

Oil-water separation, Emulsions, Adsorption

A composition for removing emulsified oil from aqueous emulsions is described. The material includes an adsorbing agent, an emulsion-breaking agent, and a hydrophobic agent.

[from Petroleum Abstracts 16(34):#223,961. 1976]

C-1996-76
NATIONAL VIEW OF WASTE MANAGEMENT AND RESOURCE RECOVERY
Hickman, H.L. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.17-26.

Wastewater treatment, Waste oil treatment, Recovery

The unsatisfactory situation in the United States in respect to the quantities and breakdown of composition of municipal, residual, and oil wastes is reviewed. Problems are highlighted and priorities for action are suggested.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6393. 1976]

C-1997-76
SOME PROBLEMS OF THE INVESTIGATION OF WASTE WATERS GENERATED IN THE PETROLEUM INDUSTRY [English summary]
Hills, E., L. Vajta, and I. Szerenyi. 1975.
Kemiai Kozlemenyek 44(1/2):21-34.

Wastewaters, Oil industry, Analytical techniques, Refineries, *Hungary

Techniques used to analyze petroleum industry effluents were studied and improvements were made for testing the wastewaters in the Hungarian refineries. Pollutants were identified, with emphasis on the determination of phenols and oil. Surface active agents in the effluents complicate the analyses of oil contaminated waters.

[from Selected Water Resources Abstracts 9(14):#76-06974. 1976]

C-1998-76
TREATMENT OF WASTEWATER CONTAINING OIL
Honma, M., M. Takesada, T. Saito, Y. Matsuzawa, S. Ninagawa, and M. Takehara. 1976.
Japanese Kokai (unexamined patent application) 76 23,486

Wastewater treatment, Crude oil, Coagulation

A process is described by which various oils, such as crude oil, heavy oils and soybean oil, are coagulated in water with N-acrylamino acid derivatives.

[from Chemical Abstracts 85(2):#10083. 1976]

C-1999-76
IMPROVED SYSTEM FOR SEPARATING OIL FROM OIL-CONTAMINATED WATER
Hydronautics, Inc. 1976.
British Patent 1,433,764

Wastewater treatment, Oil-water separation, Absorption, Coalescence

Oil-water separation is effected by a method and apparatus which utilizes the oil-absorbing and oil-coalescing properties of a porous, compressible materal. Oily water is passed through the material for absorption and coalescence of the oil. The coalesced oil is drawn off from the water, and the material is periodically compressed to expell absorbed oil and to regenerate the material.

[from Petroleum Abstracts 16(24):#220,653. 1976]

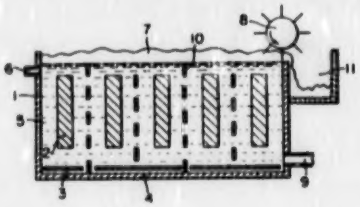
C-2000-76
METHOD OF ELECTROLYTIC TREATMENT OF WASTE WATER
Ishii, M., and M. Ichiki. 1974.
U.S. Patent 3,783,114

Wastewater treatment, Oil-water separation

A method is described for treating industrial waste water in an electrolytic cell. The scum arising from the electrolysis removes suspended matter, fats, and oils, including petroleum products.

[from Selected Water Resources Abstracts 9(15):#W76-07707. 1976]

3,783,114
METHOD OF ELECTROLYTIC TREATMENT OF WASTE WATER
Masahito Ishii and Minoru Ichiki, Tokyo, Japan, assignors to Mitsui Mining & Smelting Co., Ltd., Chuo-ku, Tokyo, Japan
Filed Feb. 18, 1972, Ser. No. 227,594
Claims priority, application Japan, Feb. 23, 1971, 46/8,856
Int. Cl. C02c *5/12*
U.S. Cl. 204—149
7 Claims



C-2001-76
APPARATUS AND METHOD FOR TREATMENT OF AQUEOUS OIL EMULSIONS
Joven, W., and R. Hanke. 1975.
German Offenlegungsschriften (unexamined patent application) 2,513,173

Wastewater treatment, Oil-water separation, Emulsions

"An electrolysis process is devised for breaking oil-waste water emulsions."

[from Chemical Abstracts 84(26):#184578h. 1976.]

C-2002-76
VERMICULITE AS A HIGHLY EFFECTIVE SOLVENT FOR REMOVAL OF PETROLEUM, PETROLEUM PRODUCTS, AND FERROUS AND NONFERROUS METAL IONS FROM WASTE WATERS [Engligh summary]
Klisuranov, G., B. Lulov, and V. Antonov. 1975.
Rudodobiv 30(9):18-21.

Wastewater treatment, Petrochemicals, *Vermiculite

Thermally expanded vermiculite (density ~ kg/m^3) is effective in the purification of petrochemical wastewaters and for the removal of Fe, Pb, and Zn ions. Primary treatment by passing the effluent through a vermiculite filter or layer is sufficient.

[from Chemical Abstracts 85(2):9927v. 1976]

C-2003-76
TREATMENT OF SULFIDE-CONTAINING WASTE WATER
Kobayashi, Y., M. Iwata, S. Yoshida, and H. Akatsuka. 1976.
Japanese Kokai (unexamined patent application)

Wastewater treatment, Refineries, Activated sludge

A method is described for treating petroleum refinery wastewaters containing sulfides. The method , which consists of treating the effluent with activated sludge in the presence of Fe catalyst and CLO2, results in improved aeration, oxidation, and settling instead of anaerobic conditions.

[from Chemical Abstracts 85(6):#36960g. 1976]

C-2004-76
TREATMENT OF WASTE WATER WITH AN ACTIVE SLUDGE
Kobayashi, Y., M. Iwata, S. Yoshida, and H. Akatuka. 1976.
German Offenlegungsschriften (unexamined patent application) 2,528,522

Wastewater treatment, Activated sludge, Refineries

"Waste water containing hydrocarbons, e.g. refinery wastes, is treated by the activated-sludge process after addition of C_{7-20} hydrocarbons, e.g. naphtha or kerosine, to remove oils."

C-2005-76
PROCESSING INDUSTRIAL EFFLUENTS
Kominek, E.G. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.137-149.

Wastewater treatment, Industries, Oil-water separation

The methods reviewed for the treatment of oil-containing effluents include: gravity separation, dispersed air flotation, granular and coalescing media filtration, diatomaceous earth filtration, centrifugation, and ultrafiltration.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6228. 1976]

C-2006-76
SEPARATION OF OIL FROM WATER
Kondo, G., and M. Asakura. 1975.
Japanese Kokai (unexamined patent application) 75 60,478

Wastewater treatment, Oil-water separation, Coagulation, Coalescence

Oil dispersed in water can be separated by adding a polymeric coagulating agent and coalescing the oil with air bubbles. At pH < 4 and > 9, anionic and cationic coagulants are used, respectively.

[from Chemical Abstracts 85(4):#25139v. 1976]

C-2007-76
INCINERATION OF FLUID RESIDUES AND SLUDGE. CINCLUS PROCESS
Laurent, M., and J.M. Pariel. 1975.
Externer Bericht, Kernforschungszentrum Karlsruhe 4(3):190-201.

Waste oil disposal, Sludge, Incineration

The Cinclus incineration method for the combustion of liquid effluents, toxic gases, and sludge is described. Particular attention is given to its application for the destruction of used oils and other liquids with high levels of hydrocarbons.

[from Environmental Health and Pollution Control 9(8):#2065. 1976]

C-2008-76
INVESTIGATING WASTE OIL DISPOSAL BY DIRECT INCINERATION
LePera, M.E., and G. DeBono. 1975.
U.S. Army Mobility Equipment Research and Development Center, Report no. 2127. 26p.

Waste oil disposal, Incineration

"Analysis of emissions from a boiler installation for lead, zinc, magnesium, calcium, particulates and gas composition gave acceptable results where a rotary cup atomizer input was used."

[from Industrial Wastes Information Bulletin 6(6):#HMS 6352. 1976]

C-2009-76
DEMULSIFICATION PROCESS
Li, N.N., T. Hucal, and R.P. Cahn. 1974.
U.S. Patent Application B 525,204

Wastewater treatment, Emulsions, Oil-water separation

In this procedure the oil-in-water emulsion is mixed with two or more comiscible volatile solvents, at least one of which is miscible with water and at least one of which is miscible with oil. Separation into an oil and water layer results, and the solvents can then be recycled by distillation of the separated oil and water.

[from Petroleum Abstracts 16(27):#221,465. 1976]

C-2010-76
INDUSTRIAL OILS, RECOVERY OR DISPOSAL [in French]
Maes, M. 1974.
Machine Moderne, November 1974, p.38-45.

Waste oil, Reclamation, Recycling, Waste oil treatment, Refining, Disposal

The technology and methods presently used to dispose of or regenerate and recover used industrial oils are reviewed. Oils are incinerated used as fuel oil, or legally and illegally dumped. Other waste oil is regenerated and re-refined by various processes involving distillation, filtration-absorption, flocculation and/or ozonation to yield new lubricating or fuel oils.

[from Selected Water Resources Abstracts 9(11):#W76-05280. 1976]

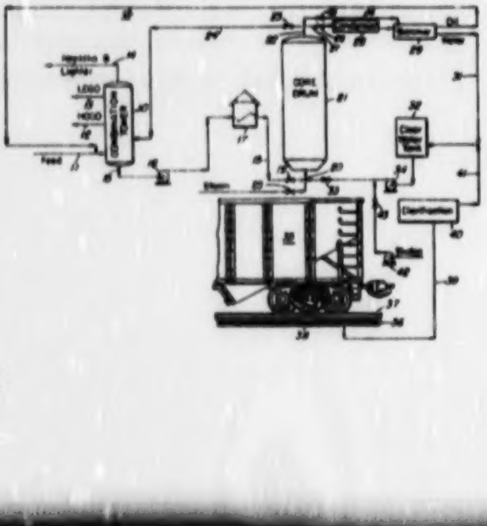
C-2011-76
DISPOSAL OF INDUSTRIAL AND SANITARY WASTES
Meyers, R.L. 1975.
U.S. Patent 3,917,564

Wastewater disposal, Waste oil, Reuse, Fuels

Oily sludges, oily wastewaters, and organic waste liquids can be used to quench coke. The dispersed hydrocarbons and organic materials become part of the primary fuel, while noncombustible solid wastes become part of the commercial coke ash.

[from Chemical Abstracts 85(4):#25127q. 1976]

3,917,564
DISPOSAL OF INDUSTRIAL AND SANITARY WASTES
Robert L. Meyers, Beaumont, Tex., assignor to Mobil Oil Corporation, New York, N.Y.
Filed Aug. 7, 1974, Ser. No. 495,460
Int. Cl.² C10G 9/14
U.S. Cl. 208—131 **4 Claims**



C-2012-76
SUMP DESIGN AND OIL/WATER SEPARATORS
Miranda, J.G. 1975.
Chemical Engineering 82(25):85.

Design and engineering, Oil-water separation, Wastewaters, Refineries, Chile

A sump design is described which has been used for successful separation of oil/water mixtures at the Empresa Nacional del Petroleo refinery at Concon, Chile. A schematic drawing of the sump system is presented.

[from Selected Water Resources Abstracts 9(9):#W76-04022. 1976]

C-2013-76
TREATMENT FOR WASTE WATER CONTAINING EMULSIFIED OIL
Miyazaki, Y., H. Kobayashi, and M. Shindo. 1976.
Japanese Kokai (unexamined patent application) 76 13,158

Wastewater treatment, Emulsions, Oil-water separation, Flocculation

Wastewater which contains emulsified oil is treated with $MgSO_4$ or $MgCl_2$, and an alkaline solution is then added, forming a flocculated layer that contains the oil and a separate layer of water. The flocculated layer is filtered off and burned, the filtrate is added to the water layer, and the mixture is neutralized and discharged.

[from Chemical Abstracts 85(6):#36962j. 1976]

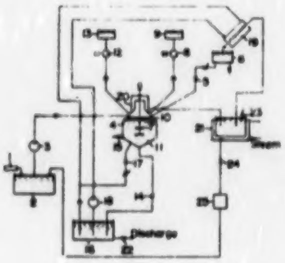
C-2014-76
METHOD FOR SEPARATING OIL FROM WATER
Miyazawa, T. 1976.
U.S. Patent 3,940,334

Wastewater treatment, Oil-water separation, *Paraffinic hydrocarbons

Paraffinic hydrocarbons with a specific gravity less than 0.8 are added as extractive solvents to oil and fat-containing wastewaters, together with inorganic and organic coagulants. Floating oily scum is removed and is distilled so as to separate the paraffinic hydrocarbons (fats and oil extraction solvents) from the mixture. The distillation vapor is then condensed to recover the paraffinic hydrocarbons, and the remaining residue is filtered and incinerated.

[from Selected Water Resources Abstracts 9(14):#W76-0744. 1976]

3,940,334
METHOD FOR SEPARATING OIL FROM WATER
Tadashi Miyazawa, Tokyo, Japan, assignor to Kayaba Industry Co., Ltd.; Mitsubishi Industries, Ltd., both of Tokyo and E. C. Chemical Industries Co., Ltd., Osaka, all of, Japan
Filed Mar. 18, 1974, Ser. No. 451,763
Claims priority, application Japan, Mar. 16, 1973, 48-30595
Int. Cl.² B01D *11/04*
U.S. Cl. 210—21 **9 Claims**



C-2015-76
BREAKING CRUDE OIL EMULSIONS
Mohr, R., R. Fikentscher, G. Liebold, K. Oppenlaender, E. Buettner, and W. Slotaman. 1976.
German Offenlegungsschriften (unexamined patent application) 2,435,713

Oil-water separation, Emulsions, Oil wells

Crude oil-saltwater emulsions at the well can be rapidly and completely demulsified by the use of quaternarized oxyalkylenated polyalkylene amines.

[from Chemical Abstracts 84(24):#167171c. 1976]

C-2016-76
FINAL TREATMENT OF PETROLEUM CONTAINING WASTE WATERS IN HIGHSPEED FILTERS FOR PUMPING THEM INTO OIL-BEARING BEDS [in Russian]
Nikiforov, G.N., and A.B. Adel'shin. 1975.
Neftepromyslovoe Delo (9):31-34.

Refineries, Wastewater treatment, Filtration, Coagulation

Rapid sand filtration and subsequent coagulation of petroleum processing wastewaters containing high concentrations of minerals and petroleum products are described. Optimal combinations of sand types, grain sizes, and filtration rates are specified, and recommended doses of the best coagulant, ammonium hydroxide, are given.

[from Selected Water Resources Abstracts 9(11):#W76-05492. 1976]

C-2017-76
COMBUSTION ON LAND OR WATER OF POLLUTANTS LIKE THICK OIL OR OTHER PETROLEUM PRODUCTS, USING ALUMINUM POWDER OR IRON OXIDE POWDER
Niklasson, R.L. 1974.
Swedish Patent 372,499

Waste oil disposal, *Combustion

A method for improving the combustion of petroleum pollutants on land and water is described which consists of spreading equal amounts of Fe oxide and aluminum powder to which lipophilic colloidal silicic acid is added.

[from Chemical Abstracts 84(26):#184596n. 1976]

C-2018-76
REMOVING FINELY DISPERSED OIL FROM WASTE WATERS
Ogihara, M., S. Hata, S. Ito, H. Ohkura, S. Nakai, and H. Shiraishi. 1976.
Japanese Kokai (unexamined patent application) 76 25,487

Wastewater treatment, Oil-water separation, Coalescence

A composition which coalesces and separates oil from wastewaters such as tank washings and bilges is described. The composition contains $RO(CH_2CH_2O)_nH$, where R is C_{10-16} alkyl or alkenyl and n is 1-7, representing the average number of moles of ethylene oxide added.

[from Chemical Abstracts 85(8):#51406z. 1976]

C-2019-76
THE BP EFFLUENT TREATMENT PROCESS
Oldham, G.F. 1975.
Externer Bericht, Kernforschungszentrum Karlsruhe 4(3):154-157.

Wastewater treatment, Refineries, Oil-water separation, Filtration

Details are presented on an alternative refinery treatment process developed by BP Engineering Department to achieve a high degree of purification reliably and cheaply. The process consists of mechanical separation of oils, percolating filters for biological treatment of the wastewaters, and use of a final lagoon to avoid peak concentrations and to discharge a final effluent as close to its average quality as possible.

[from Environmental Health and Pollution Control 9(4):#1073. 1976]

C-2020-76
BIOLOGICAL TREATMENT OF WASTE WATERS FROM REFINERIES AND PETROCHEMICAL PLANTS [English summary]
Ono, H. 1975.
Shigen 193:39-46.

Wastewater treatment, Refineries, Petrochemicals, *Biological treatment

"A discussion."

[from Chemical Abstracts 85(8):#51273d. 1976]

C-2021-76
TREATMENT OF WASTE WATER-CONTAINING OIL BY AN ADSORPTION TECHNIQUE
Ono, H., and T. Saida. 1975.
Kagaku Kojo 19(4):87-91.

Wastewater treatment, Oil-water separation, Adsorption, Flocculation

"The MTC oil separator and the flocculant Mitsui-Floc 5000 were used. The oil separator consisted of a sand filter and an oil adsorption tower packed with peat and reduced the oil in wastewater from 203-4800 ppm to 0.3 to 4.0 ppm. The flocculant was a low-molecular-weight organic compound and adsorbed water-soluble organic compounds, nonionic surfactants, and 3 times as much oil as polyaluminum chloride."

[from Chemical Abstracts 84(24):#169152w. 1976]

C-2022-76
SEPARATION OF OIL FROM WASTE WATER CONTAINING THE OIL IN THE FORM OF FINE DROPLETS
Ono, H., T. Saida, and K. Fukumara. 1975.
German Offenlegungsschriften (unexamined patent application) 2,522,250

Wastewater treatment, Oil-water separation, Emulsions, Adsorption

Oil emulsions can be demulsified and the oil adsorbed by treatment with metal hydroxides or oxides. HCl is added to bring the pH to 7 and dissolve the hydroxides the oil then floats to the surface or coalesces into larger, filterable droplets.

[from Chemical Abstracts 84(24):#169286t. 1976]

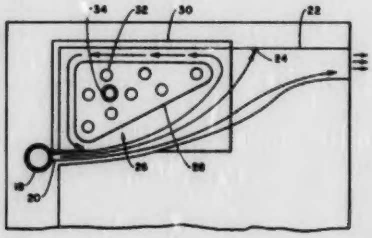
C-2023-76
COANDA EFFECT OIL-WATER SEPARATOR
Paszyc, A.J., D. Pal, and J.B. Curry. 1976.
U.S. Patent 3,945,920

Wastewater treatment, Oil-water separation, *Coanda effect

An oil water separating device is described which employs the wall attachment effect (the Coanda effect) for the continuous separation of oil from an oil-water mixture.

[from Petroleum Abstracts 16(25):#220,843. 1976]

3,945,920
COANDA EFFECT OIL-WATER SEPARATOR
Aleksy J. Paszyc, Ventura; Dharam Pal, Woodland Hills, and John B. Curry, Oxnard, all of Calif., assignors to The United States of America as represented by the Secretary of the Navy, Washington, D.C.
Filed Oct. 3, 1974, Ser. No. 511,906
Int. Cl.^{2} B01D *21/26*
U.S. Cl. 210—73 W **3 Claims**



C-2024-76
REVERSE OSMOSIS/ULTRAFILTRATION SYSTEMS
Paterson Candy International Ltd.
Laverstoke Mills, Whitchurch, Hampshire RG28 7NR.

Wastewater treatment, Waste oil treatment, Filtration

"Ultrafiltration of waste soluble oil, osmosis purification of brackish and seawater, sewage effluent, industrial and radioactive wastes, pharmaceuticals and chemicals, and preparation of boiler feed and pure water are described."

[from Industrial Wastes Information Bulletin 6(6):#HMS 6329. 1976]

C-2025-76
WASTEWATER TREATMENT TECHNOLOGY
Patterson, J.W. 1976.
Michigan, Ann Arbor Science Publishers. 1976. 265p.

Wastewater treatment, Industries, Waste oil disposal

Wastewater treatment techniques for removing 22 major industrial pollutants are reviewed. Typical sources and concentrations of oil pollutants are given and available abatement procedures are discussed. Pilot plant and full-scale facilities for oil removal are also presented.

[from Chemical Engineering 83(13):12. 1976]

C-2026-76
SORPTION PURIFICATION OF OIL-CONTAINING WASTE WATERS. I. KINETICS OF THE SORPTION OF OIL PRODUCTS BY HYDRATED OXIDE DEPOSITS [in Russian]
Petrova, N.A., G.E. Dubrovskaya, V.G. Berezyuk, and V.V. Pushkarev. 1976.
Zhurnal Prikladnoi Khimii (Leningrad) 49(1):140-144.

Wastewater treatment, Oil-water separation, Absorption

"Freshly precipitated hydroxides of Fe and Al were used as sorbents and $AlCl_3$, $FeCl_3$, and $FeSO_4$ as coagulants. The experiments were formed under static conditions under weakly acid or neutral pH. The kinetics of oil sorption was first order. The rate constants and activation energies of the process indicated physical sorption, limited by the diffusion process. Raising the temperature to 40-50° significantly increased the rate of the sorption process."

[from Chemical Abstracts 85(6):#36877k. 1976]

C-2027-76
SEPARATION OF HYDROCARBONS FROM WATER
Preus, P. 1975.
Belgian Patent 824,559

Oil-water separation, Hydrocarbons, Absorption

Petroleum hydrocarbons can be absorbed from water by an oleophilic and hydrophobic fluid granular mass composed of expanded perlite (70%), cellulose fibers (23%), clay (6%), and asphalt (1%). One liter of absorbent effectively absorbs 75-125 l of petroleum.

[from Chemical Abstracts 84(24):#16927q. 1976]

C-2028-76
APPARATUS AND METHOD FOR THE CHEMICAL-BIOLOGICAL PURIFICATION OF WASTE WATERS
Pueschel, S., and L. Wenige. 1975.
East German Patent 112,747

Refineries, Wastewater treatment, Flocculation

CO_2 or CO_2-containing air is used to eliminate mercaptans and H_2S in petroleum refinery waste waters, followed by biological treatment, compressed air treatment, and flocculation.

[from Chemical Abstracts 84(26):#184614s. 1976]

C-2029-76
ACTIVATED CARBON CLEARS EFFLUENT
Rizzo, J.A. 1976.
Oil and Gas Journal 74(22):52-56.

Wastewater treatment, Refineries, Texas, *Activated carbon

Full scale tests for reducing effluent-suspended solids in biological treating facilities with the addition of activated carbon have been completed at Sun Oil Company's Corpus Christi, Texas, refinery. These tests were conducted to expand treatment performance and to meet the 1977 National Pollution Discharge Elimination Systems and Texas Water Quality Board permit limitations. The treatment process is described.

C-2030-76
PURIFICATION OF OIL BEARING EFFLUENTS BY GAS FLOTATION
Roenneke, H. 1974.
Wastes-Solids, Liquids, Gases. New York, Chemical Publishing Company, 1974. p.57-65.

Wastewater treatment, Emulsions, Flotation

The gas flotation process for separating emulsified oils from industrial wastewaters is reviewed, and its theoretical and practical advantages as well as its shortcomings are examined. The economics of its industrial application is also considered.

C-2031-76
PHENOLS. A WATER POLLUTION CONTROL ASSESSMENT
Rosfjord, R.E., R.B. Trattner, and P.N. Cheremisinoff. 1976.
Water and Sewage Works 123 (3):96-99.

Wastewater treatment, *Phenols, Refineries, Bibliographies

The polluting effects of phenols and methods for removing them from wastewaters such as those from the refining and petrochemical industries are reviewed. Data on proposed and existing standards for phenols in wastewaters, and an extensive bibliography are included in the report.

[from WRC Information 3(19):#76-1423S. 1976]

C-2032-76
WASTE WATER TREATMENT MATERIAL
Sato, H., M. Arita, S. Fujii, and T. Kakuda. 1976.
German Offenlegungsschriften (unexamined patent application) 2,543,007

Wastewater treatment, Oil-water separation, Adsorption

Oils can be adsorbed from water by using powdered magnesium oxide or magnesium hydroxide on a carrier such as polypropylene or polystyrene.

[from Chemical Abstracts 85(2):#10090y. 1976]

C-2033-76
APPARATUS FOR SEPARATING OIL-IN-WATER USED EMULSIONS, ESPECIALLY DRILLING FLUIDS
Schmidt, R., W. Florberg, and M. Schneemilch. 1975.
East German Patent 111,516

Oil-water separation, Emulsions, Filtration, *Drilling fluids

"Oil-in-water emulsions, e.g. drilling fluids, are broken by using a filter and controlled heating."

[from Chemical Abstracts 84(26):#184605q. 1976]

C-2034-76
FLOCCULANT USE ON TANKERS
Shewmaker, J.E. 1976.
Final report on Task 1, EE. 5TMR. 76, MA-RD-940-76035. Contract MA-1-35049. 50p.

Oil-water separation, Wastewaters, Tankers, Flocculation

Flocculation with montmorillonite clay was found to improve oil-water separation at a very rapid rate; the treated water contained about 20-50 mg/kg (ppm) of oil compared to several hundred mg/kg (ppm) in the control tank undergoing unaided gravity separation.

[from Government Reports Announcements 76(13):#PB-251 626/8GA. 1976]

C-2035-76
WATER SUPPLY AND ULTILIZATION IN A REFINERY
Siebert, M. 1975.
Forum der Umwelthygiene 26(7):189-191.

Wastewater treatment, Refineries, Water quality, Europe

This paper outlines the organization, distribution, and utilization of the water supply at the Worth refinery, with emphasis on the pretreatment of process water and wastewater purification. In comparing water contamination data to European and American standards, it is shown that all parameters meet present and expected future water quality requirements.

[from Environmental Health and Pollution Control 9(9):#2274. 1976]

C-2036-76
TREATMENT OF DRILLING EFFLUENTS [in French]
Sirvins, A., and B. Tramier. 1975.
Bulletin de Centre de Recherches de Pau 9(2):407-420.

Wastewater treatment, Drilling

Drilling fluid waste discharges are made environmentally acceptable by a three-step process which involves (1) acidification-decantation; (2) biological treatment; and (3) physico-chemical treatment.

[from Petroleum Abstracts 16(24):#220,654. 1976]

C-2037-76
USCG OILY WATER SEPARATOR SYSTEM CARTRIDGE USAGE DATA SURVEY
Skewes, R.L. 1976.
Final report, USCG-D-40-76. 73p.

Oil-water separation, Ships, Economics, *U.S. Coast Guard

Oily water separator systems in eight U.S. Coast Guard cutters were surveyed. Cost analysis data and filter coalescer cartridge usage rates were obtained for several different systems.

[from Government Reports Announcements 76(12):#AD-A023428/6GA. 1976]

C-2038-76
TREATING CHEMICAL WASTES BY EVAPORATION
Stickney, W.W., and T.M. Fosberg. 1976.
Chemical Engineering Progress 72(4):41-46.

Wastewater treatment, Refineries, Evaporation

An evaporative system known as the brine concentrator is explained with emphasis on treating wastewaters from oil refineries and other industries.

[from WRC Information 3(28):#76-2004S. 1976]

C-2039-76
ON-SITE DISPOSAL OF SLUDGES FROM EFFLUENT TREATMENT PLANT OUTS COSTS
Sweeney, F.J. 1975.
Oil and Gas Journal 73(27):52-54.

Refineries, Wastewater treatment, Wastewater disposal, Recycling, Sludge

For economic and environmental reasons, on-site land disposal of wastes was chosen for the 6.7 million l/d (42,000 b/d) Shell refinery at Oakville. Details of the effluent treatment plant, its method of operation, and effluent analytical data are presented. The effluent treatment scheme is believed to be the most effective method of recycling wastes as well as the most economic disposal method yet devised.

[from International Petroleum Abstracts 4(1):#267. 1976]

C-2040-76
AN ACTUAL EXAMPLE OF WASTE WATER TREATMENT IN A PETROLEUM FACTORY
Tada, H. 1974.
All-Japan Pollution Control Technical Conference, Tokyo, 1974. p.11-20.

Oil industry, Petrochemicals, Wastewater treatment, Japan

The wastewater treatment facilities of the Oita (Japan) petrochemical complex are detailed. Methods used in the neutralization, treatment, and clarification of the effluents from various plants within the complex are discussed. Treatment costs, analysis and measurement of wastes, and future expansion plans for the water treatment system are reviewed.

[from Selected Water Resources Abstracts 9(15):#W76-07717. 1976]

C-2041-76
EMULSION BREAKING METHOD
Tao, F.S. 1975.
U.S. Patent 3,928,194

Wastewater treatment, Oil-water separation, Emulsions, Dispersions

A method for separating an oil and water emulsion into separate oil and water phases consists of converting the emulsion into a dispersion which will separate into distinct phases upon settling. The conversion is achieved by mixing with a demulsifier or by first adding a demulsifier and a sufficient amount of the emulsified material to effect an inversion and mixing.

[from Selected Water Resources Abstracts 9(12):#W76-05527. 1976]

C-2042-76
EMULSION BREAKING METHOD
Texaco Development Corporation. 1976.
British Patent 1,435,614

Oil-water separation, Emulsions, *Demulsification

A process is described in which water-in-oil emulsions are first inverted to oil-in-water emulsions, followed by addition of demulsifier and sufficient mixing to demulsify and separate the water and oil.

[from Petroleum Abstracts 16(27):#221,466. 1976]

C-2043-76
DEMULSIFIER MIXTURES FOR BREAKING OF CRUDE OIL EMULSIONS
Theile, H., H. Hoffmann, G. Rossmy, G. Koerner, and P. Zaske. 1976.
German Patent 2,250,920

Crude oil, Emulsions, *Demulsification

Crude oil emulsions are broken by a mixture consisting 70-99.8% of a specified, silicon-free demulsifier and 0.2-30% of a mixed block polymer composed of polyoxy alkylene and polysiloxane.

[from Petroleum Abstracts 16(27):#221,464. 1976]

C-2044-76
APPARATUS AND METHOD FOR SEPARATING OIL FROM AN OIL-WATER MIXTURE
Toft, K.H. 1975.
German Offenlegungsschriften (unexamined patent application) 2,420,977

Oil-water separation, Wastewater treatment

"A separator is described for removing oil from natural waters."

[from Chemical Abstracts 84(26):#184761n. 1976]

C-2045-76
AGENTS FOR SEPARATION OF OIL EMULSION
Wakabayashi, Y., and H. Takado. 1975.
Japanese Kokai (unexamined patent application) 75 159,880

Wastewater treatment, Oil-water separation, Emulsions, Flocculation

A powder made from 20-40% $CaCl_2$-containing clay, 60-80% $Al_2(SO_4)_3$-containing clay, and 0.3-1.0 weight % flocculants forms an effective agent for separating oil from water in a surfactant-containing oil emulsion.

[from Chemical Abstracts 84(26):#184621s. 1976]

C-2046-76
EXPERIENCE WITH THE PURIFICATION OF WASTE WATERS IN RESERVOIRS [in Russian]
Zikunov, A., and S. Akzigitov. 1974.
Neftepromyslovoe Delo Vol. 1:38-40.

Wastewater treatment, Oil-water separation, Emulsions, Refineries, Petrochemicals

The removal of oil from petroleum refining and petrochemical industry wastewater reservoirs is discussed. The method consists basically of admitting the effluent to vertical settling tanks, draining off surface oils, then demulsifying and removing emulsified oils.

[from Selected Water Resources Abstracts 9(15):#W76-07538. 1976]

6. RECLAMATION AND REUSE

C-2047-76
NEW REREFINING PROCESS UNVEILED FOR WASTE LUBE OILS
Anon. 1976.
Chemical Engineering 83(14):39.

Waste oil treatment, Lubricating oil, Reclamation

A new rerefining process for waste lubricating oils which avoids the traditional acid or clay-sludge disposal problems has been developed. Spent lube oil is first dehydrated, then vacuum distilled to remove residual asphaltenes, and hydrofinished for stabilization. A final stripping process removes volatile hydrocarbons for fuel use, leaving a primary lubricating oil base stock product.

C-2048-76
REREFINING AND RECYCLING OF LUBRICANTS
Anon. 1976.
Lubrication Engineering 31(2):72-74.

Refining, Recycling, Lubricating oils, Waste oil treatment

"Proceedings of a panel discussion held at the 1975 ASLE Annual Meeting are reported. Topics dealt with include economics, practical problems, additive depletion, waste disposal and general lubricant conservation."

[from International Petroleum Abstracts 4(1):#152. 1976]

C-2049-76
EXPERIMENTAL BURNING OF WASTE OIL AS A FUEL IN CEMENT MANUFACTURE
Berry, E.E., L.P., MacDonald, and D.J. Skinner. 1975.
Technology development report, EPS4-WP-75-1. 187p.

Waste oil, Lubricating oil, Reuse, Fuels

In an experimental program at St. Lawrence Cement Company, Ltd, Mississauga, Ontario, 1.25 million l (330,000 gals) of used lubricating oil were burned as a portion of the total fuel requirement for a dry-process cement kiln. Emission data are reported.

[from Selected Water Resources Abstracts 9(9):#W76-04177. 1976]

C-2050-76
RE-REFINING OF USED LUBRICATING OIL
Chatwin, A.H. 1975.
Petroleum Review 29(346):713-716.

Reclamation, Refining, Lubricating oil, Waste oil treatment, Conservation, Economics

Various aspects of the re-refining of used lubricating oils are discussed including economics, supply, and conservation. Historical developments in re-refining are outlined, and present processes and problems in collecting, treating, and re-refining used oils are described.

[from International Petroleum Abstracts 4(1):#153. 1976]

C-2051-76
REGENERATING USED MOTOR OILS
Ditman, J.G. 1975.
French Demande 2,257,678

Waste oil treatment, Reclamation, Lubricating oils

"Used motor oils are regenerated to give lubricating oils of good color and viscosity by the process of extraction by vapor to remove volatile impurities, deasphalting, and catalytic hydrogenation."

[from Chemical Abstracts 84(5):#23473a. 1976]

C-2052-76
WASTEWATER RE-USE SAVES ON COOLING-TOWER MAKE UP
Harpel, W.L., and E.W. James. 1975.
Oil and Gas Journal 73(35):118-119.

Refineries, Wastewater treatment, Reuse, Recycling

Oil refinery and other plant effluent waters can be used for cooling water makeup if proper selection and treatment methods are employed. Thorough analysis and treatment of such wastewaters to minimize scaling, fouling, and corrosion potential are necessary before recycling and reuse for cooling.

[from International Petroleum Abstracts 4(1):#122. 1976]

C-2053-76
EXPERIMENTAL BURNING OF WASTE OIL AS A FUEL IN CEMENT MANUFACTURE
MacDonald, L.P., and E.E. Berry. 1975.
Ontario Industrial Waste Conference, 22nd, 1975.
Ontario Ministry of the Environment, 1975 [?]. p.353-366.

Waste oil, Lubricating oil, Reuse, Fuels

Emission data are given from an experimental program at St. Lawrence Cement Co., Ltd., Mississauga, Ontario, in which used lubricating oil was burned for fuel in a dry-process cement kiln.

[from Pollution Abstracts 7(3):#76-02456. 1976]

C-2054-76
REREFINED OIL: AN OPTION THAT SAVES OIL, MINIMIZES POLLUTION
Maugh, T.H., II. 1976.
Science 193(4258):1108-1110.

Waste oil, Recycling, Lubricating oil, Legislation, U.S.

The changing situation regarding the rerefining of used oil in the United States is described. New rerefining processes have been developed that eliminate environmental problems characteristic of older technologies. Federal and local governments have become more interested in promoting the collection of waste oils, and the federal government is moving to change the tax structure and legislation which previously hindered the reuse of lubricating oils.

C-2055-76
REGENERATION OF WASTE LUBRICATING OIL
Okamoto, N., M. Muto. 1976.
Japanese Kokai (unexamined patent application) 76 12,801

Waste oil treatment, Lubricating oil, Reclamation

A process is described for the regeneration of waste lubricating oil which involves heating with ethylene-diamine, filtering or centrifuging,and optionally stripping.

[from Chemical Abstracts 84(24):#169344k. 1976]

C-2056-76
THE RECYCLING INDEX
Russell, T.W.F., and M.W. Swartzlander. 1976.
Chemtech January:32-37.

Information systems, Recycling, Waste oil

This index indicates the current technical potential for recycling a chemical or product. Values for the top 50 U.S. chemicals (by production) and 40 organic intermediates (by market value) are listed.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6266. 1976]

C-2057-76
RECOVERY, RE-REFINING, AND REUSE OF WASTE OIL AT SAGINAW STERRING GEAR
Schrader, B.L. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.67-69.

Recycling, Waste oil, Design and engineering, Skimmers

A simple, effective flotation system for recovering non-emulsified oil is described which is based on the use of a specially designed roll skimmer.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6259. 1976]

C-2058-76
ASTM COMMITTEE D2 AND THE PETROLEUM REREFINING INDUSTRY
Stringer, P.L. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.107-114.

Reclamation, Waste oil, Oil industry, *Testing methods

This paper contains a discussion of simplified testing of re-refined oils for various purposes. Studies are in progress to evaluate instrumental methods to replace expensive performance testing.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6261. 1976]

C-2059-76
PROPERTIES OF RECYCLED HYDRAULIC AND LUBRICATING OILS
Two, A.B. 1975.
Lubrication Engineering 31(2):68-71.

Reclamation, Recycling, Waste oil, Lubricating oil

The conservation of crude oil by recycling of used oils is noted; and the re-refining process, its practicability, and its limitations are discussed. Properties and testing procedures for re-refined oils are reviewed, and limitations in the application of such oils are emphasized.

[from International Petroleum Abstracts 4(1):#222. 1976]

C-2060-76
INDUSTRY PAPER FIBER, PLASTICS AND CHEMICALS
Walters, R.K. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p.47-53.

Reclamation, Reuse, Waste oil, Lubricating oil

The oil conservation practices being used at Tennessee Eastman Company are outlined. Purification and reuse are discussed. The main problems in reusing oil are the determination of contaminants and what additives are required. Eighty-five percent of lubricating oil can be reclaimed.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6257. 1976]

7. PERSONNEL TRAINING AND EDUCATION

C-2061-76
MEDIA AND MEDITERRANEAN PROTECTION (news brief)
Anon. 1976.
Marine Pollution Bulletin 7(3):56.

Pollution prevention, Personnel training, Mediterranean Sea

The United Nations Environment Programme and the International Public Relations Association held a seminar in Athens last November entitled, Mediterranean Community: Laboratory for Survival. Four workshops were held to stimulate public awareness and to improve links between journalists, public relations professionals, and specialists dealing with such problems as oil pollution, dumping of chemicals and sewage, and the like.

C-2062-76
TRAINING SCHOOL IN OIL SPILL TECHNIQUES PROVIDES VALUABLE SERVICE
Anon. 1976.
Offshore 36(6):109.

Personnel training, Oil spills, Cleanup

A training school for the study of Oil Spill Cleanup techniques was recently held at Merritt Ship Repair Co., Oakland, California. Sponsored by Crowley Environmental Services (CES) Corporation, the school covered various important topics including: recovery devices, oil treating agents, containment booms, waste removal, and spill prevention. Field exercises included the use of skimmer devices, booms, storage tanks, and sorbent materials.

C-2063-76
BLOWOUT PREVENTION IS MISTAKE PREVENTION
Coppes, J., and N.E. Rudd. 1976.
SPE-AIME European Spring Meeting, Amsterdam, 1976.
Preprint no. SPE-5756. 11p.

Personnel training, Blowout prevention, Drilling, Oil wells

Although the drilling industry has made important technological advances in blowout prevention, mistakes in well control continue to occur, partly because of inadequate training of rig personnel in the use of equipment and methods. Current training programs are examined and analyzed, and the need for further development in training methods is stressed.

[from Petroleum Abstracts 16(22):#220,181. 1976]

C-2064-76
BLOWOUT CAUSE AND CONTROL: A CASE HISTORY
Taylor, G.E. 1976.
Petroleum Engineering 48(7):82,84.

Blowout prevention, Personnel training, Drilling, Texas

Although causes, prevention, and control of blowouts are periodically reviewed in drilling company personnel training, personnel caused blowouts still occur. A case history of a blowout at a drilling operation in Texas is reviewed, and its cause and control are described.

[from Petroleum Abstracts 16(32):#223,374. 1976]

8. CONTINGENCY PLANNING

C-2065-76
OIL SPILL GROUP FORMED (news brief)
Anon. 1976.
Pacific Oil World 69(6):13.

Oil spills, Southern California, OCS

A Southern California Petroleum Contingency Organization (SC-PCO) has been formed by oil companies which will be operating in the newly leased Southern California Outer Continental Shelf area. The group will be responsible for oil spill containment and cleanup should an oil spill occur.

C-2066-76
OIL SPILL CONTROL. PART 2. COUNTER MEASURES
D'Allesandro, P.L., and C.B. Cobb. 1976.
Hydrocarbon Processing 55(3):145-148.

Oil spills, Cleanup, *Counter measures

Countermeasure activity in case of an oil spill includes four sequential responses: detection, containment, recovery, and disposal. According to this study, contingency plans are those procedures activated when oil reaches navigable water. In practice, however, countermeasures and contingency plans are often inseparable.

[from Petroleum Abstracts 16(22):#220,235. 1976]

C-2067-76
OIL SPILL CONTINGENCY PLANNING IN THE PETROLEUM INDUSTRY
Fern, G.R.H. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.12-13.

Oil spills, Canada, Oil industry, Guidelines

An Oil Industry Contingency Plans National Co-ordinating Committee has been established to provide for the coordination of contingency planning on a national basis. Sponsored by the Petroleum Association for Conservation of the Canadian Environment (PACE), this organization seeks to improve the quality of oil spill contingency planning, to provide a single point of industry contact with concerned federal government departments, and to provide guidelines for the operation of local petroleum industry oil spill cooperatives.

[from Petroleum Abstracts 16(28):#221,965. 1976]

9. PREVENTIVE AND CONTROL MEASURES

C-2068-76
ADDED CARCASS PREVENTS OIL SPILL
Anon. 1975.
Oilman, 13 September 1975. p.8.

Pollution prevention, Containment, Oil spills

Dunlop has developed a floating hose with a secondary carcass capable of withstanding pressures well over 100-150 psi, which are the standard pumping pressures. According to Dunlop, use of the double carcass hose will prevent oil spills and contain oil if the primary hose fails.

[from Fuel Abstracts 17(4):#2359. 1976]

C-2069-76
CAMERON TYPE "U" BLOWOUT PREVENTERS (product information)
Anon.
Cameron Iron Works, Inc., P.O. Box 1212, Houston, TX 77001

Blowout prevention, Drilling, Offshore drilling, Design and engineering

The Cameron Type "U" Blowout preventer is designed for onshore as well as marine oil well drilling operations. The rated continuous working pressure for these units is 1500 psi (105 kg/cm^2), but the units are designed to function at pressures as low as 300 psi (21 kg/cm^2) and as high as 5000 psi (350 kg/cm^2). The company also furnishes complete blowout preventer stacks and other drilling-related equipment.

C-2070-76
PLASTIC LINING GIVES WARNING OF TANK LEAKS
Anon. 1974.
Petroleum International 14(6):51.

Pollution prevention, Leakage, Oil spills, Oil tanks

Accidental oil leakage or spillage from storage tanks can be prevented by the new Lystek GRP technique. The technique involves coating the tank base and surrounding area with an impermeable membrane made from glass fibres and polyester resin which is then covered with sand and aggregate. Leaks or spills are easily detected and are contained without causing pollution.

[from Fuel Abstracts 17(4):#2403. 1976]

C-2071-76

EXPLANATION OF SHALLOW BLOWOUTS AND LOST TIME INCIDENTS WITH SOME RECOMMENDATIONS

Baird, R.W. 1976.

Offshore Technology Conference, 8th, Houston, 1976. Preprint no. OTC-2610. Vol. 2. p.925-941.

Blowout prevention, Offshore drilling

Causes of major blowouts in drilling in the marine environment are reviewed with recent case histories given as examples. In each case, the blowout could have been avoided with prior knowledge of the hazard involved. Recommendations include modification of drilling plans by drilling engineers to compensate for potential hazards.

[from Petroleum Abstracts 16(25):220,744. 1976]

C-2072-76

PROTECTION METHOD

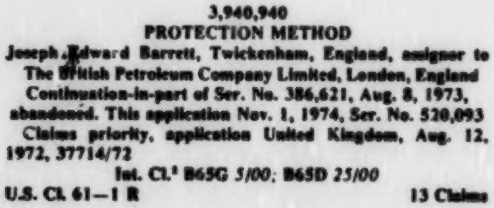
Barrett, J.E. 1976.

U.S. Patent 3,940,940

Pollution prevention, Oil spills, Oil tanks, Leakage

Ground surfaces are protected from spilled oil in storage tank areas by covering the ground with a sheet treated with fiber-reinforced polyester resin. The cured polyester resin sheet protrudes beyond the storage tanks so that leakage from the tank can collect on the sheet.

[from Petroleum Abstracts 16(27):#221,555. 1976]



3,940,940

PROTECTION METHOD

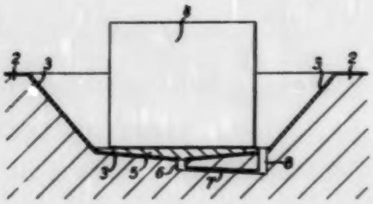
Joseph Edward Barrett, Twickenham, England, assignor to The British Petroleum Company Limited, London, England

Continuation-in-part of Ser. No. 386,621, Aug. 8, 1973, abandoned. This application Nov. 1, 1974, Ser. No. 520,093

Claims priority, application United Kingdom, Aug. 12, 1972, 37714/72

Int. Cl.² B65G *5/00*; B65D *25/00*

U.S. Cl. 61—1 R **13 Claims**



C-2073-76
DEALING WITH INLAND SPILLS
Bonsor, J. 1976.
Pollution Monitor No. 29:19.

Oil spills, Inland, Pollution prevention, Legislation

"The growing danger of inland oil spills, and the present situation regarding prevention and control are outlined. The author advocates the establishment of an inland advisory and research department, which would correspond to the marine oil pollution division of Warren Spring Laboratory, tighter legislation on the reporting of spills, and fines for oil spill offences which should be graduated to encourage preventive measures, such as the stocking of absorbent materials and retaining booms."

[from WRC Information 3(17):#76-1282S. 1976]

C-2074-76
EFFORTS MADE BY THE OIL COMPANIES TO PROTECT THE ENVIRONMENT IN HYDROCARBON STORAGE DEPOSITS [English summary]
Chirac, M. 1975.
Revue de l'Association Francaise des Techniques du Petrole, No. 234. p.69-72.

Environmental protection, Inland, France, Containment, Cleanup, Oil spills

Efforts by eight French oil companies to protect the inland environment from oil pollution are detailed. Of their investment since 1972 of over 80 million francs, about 20% is for containment of accidental spills, about 60% for special sealing of containment dikes, and 20% for collection, separation and treatment of polluted water.

[from Petroleum Abstracts 16(23):#220,480. 1976]

C-2075-76
QUICK LATCHING DRILL PIPE BLOWOUT PREVENTER AND METHOD OF USE THEREOF
Coone, M.G. 1976.
U.S. Patent 3,958,642

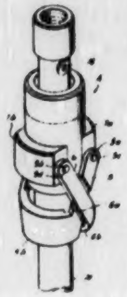
Blowout prevention, Oil wells, Design and engineering, Drilling

A blowout preventer is described which is quickly and sealably latchable to the upper tool joint of the drill string in the event of a well blowout. The basic elements of the apparatus are enumerated, and a method for containing well and drilling fluids using this blowout preventer is described.

[from Petroleum Abstracts 16(33):#223,659. 1976]

(Patent illustration on the following page)

3,958,642
QUICK LATCHING DRILL PIPE BLOWOUT PREVENTER
AND METHOD OF USE THEREOF
Malcolm G. Coone, Houston, Tex., assignor to Lynes, Inc., Houston, Tex.
Filed Sept. 2, 1975, Ser. No. 609,606
Int. Cl.^{2} E21B *19/00, 43/00*
U.S. Cl. 166—315 **20 Claims**



C-2076-76
ELECTRONIC FLUID PIPELINE LEAK DETECTOR AND METHOD
Covington, M.T., and S.M. Griffin. 1974.
U.S. Patent Application B 530,709

Pipelines, Leakage, Pollution prevention, Design and engineering

An electronic pipeline leak detector is described which monitors pipeline pressure and/or fluid flow rates. Changes in the rates of flow or pressure over a predetermined period of time activate alarm systems and/or pipeline closure valves.

[from Petroleum Abstracts 16(31):#222,928. 1976]

C-2077-76
MANUAL ON THE AVOIDANCE OF POLLUTION OF THE SEA BY OIL
Department of Trade. 1974.
London, H.M. Stationery Office, 1974. 28p. (Fourth edition).

Manuals, Pollution prevention, Oil spills, Leakage, Oil discharges, Legislation

"This revised manual on avoidance of pollution of the sea by oil concentrates on deliberate and careless discharges. The law on the deliberate discharge ofoil, which has recently been strengthened, is summarized. Other sections deal with the prevention of spillages, leakages and accidental discharges, and the procedure should a spillage occur into dock or harbour waters; the disposal of oil-contaminated water and oil residues; and the keeping of records of oil landing, transfer, discharge, and disposal of oily ballast, bilges, etc., with requirements for records inspection."

[from WRC Information 3(12):#76-947S. 1976]

C-2078-76
COUNTERMEASURES TO CONTROL OIL SPILLS IN WESTERN CANADA
Hall, P.L. 1976.
Ground Water 14(3):163-170.

Oil spills, Groundwater, Canada, Legislation, Manuals, Oil industry, Pollution prevention

Governments and industries in Western Canada are expressing an increasing concern over groundwater pollution from hydrocarbons. New legislation on handling of refined oil products is being developed in Manitoba and a series of oil spill manuals which describe procedures for controlling leaks and spills of oil products is being prepared by the petroleum industry. Emphasis is being placed on education and prevention.

[from Petroleum Abstracts 16(28):#221,975. 1976]

C-2079-76
BLOWOUT-PREVENTERS FOR UNDERWATER DRILLING
Meynier, M.J. 1974.
Erdoel und Erdgas Zeitschrift 90(12):463-466.

Blowout prevention, Offshore drilling, Design and engineering

"The development of blowout preventers for offshore applications in the past 25 years is reviewed, the current situation is disscussed and possible future requirements are indicated."

[from Fuel Abstracts 17(4):#2335. 1976]

C-2080-76
OIL AND GAS WELL DISASTER VALVE CONTROL SYSTEM
Parker, W.H. 1976.
U.S. Patent 3,961,308

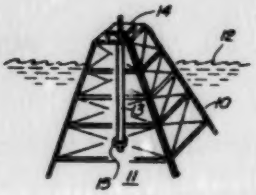
Blowout prevention, Oil wells, Pollution prevention, Design and engineering

A disaster valve for shutting off an oil well in case of a blowout is described. The valve is controlled by a signal transmitted through the walls of tubing extending down into the well. If the signal disappears, the valve shuts.

[from Petroleum Abstracts 16(37):#224,717. 1976]

(Patent illustration on the following page)

3,961,308
OIL AND GAS WELL DISASTER VALVE CONTROL SYSTEM
William H. Parker, Hurst, Tex., assignor to Del Norte Technology, Inc., Euless, Tex.
Filed Oct. 2, 1972, Ser. No. 294,289
Int. Cl.² G01V *1/14*; E21B *35/00*
U.S. Cl. 340—18 NC **7 Claims**



C-2081-76
CATHODIC PROTECTION WELLS AND GROUND-WATER POLLUTION
Ritchie, E.A. 1976.
Ground Water 14(3):146-149.

Pollution prevention, Groundwater, Pipelines, *Corrosion

Cathodic protection is a technique used to prevent or minimize electrolytic corrosion of pipelines, tanks, etc., by redirecting the current to a substitution anode which then deteriorates instead of the pipeline. Development of the vertical deep anode cathodic protection well is discussed.

[from Petroleum Abstracts 16(28):#222,049. 1976]

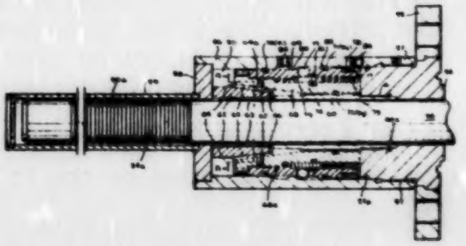
C-2082-76
BLOWOUT PREVENTER LOCKING APPARATUS AND METHOD
Roberts, E.L. 1976.
U.S. Patent 3,941,141

Blowout prevention, Design and engineering, Drilling

Details of a locking apparatus for a ram-type blowout preventer are presented, and a method for operating the ram-type blowout preventer is described.

[from Petroleum Abstracts 16(25):#220,747. 1976]

3,941,141
BLOWOUT PREVENTER LOCKING APPARATUS AND METHOD
Eddie L. Robert, 9722 Galston, Spring, Tex. 77373
Filed May 3, 1974, Ser. No. 466,548
Int. Cl.² E21B *33/06*
U.S. Cl. 137—1 **21 Claims**



C-2083-76
PREVENTION OF OIL POLLUTION IN TIDAL ESTUARIES
Sallabanks, L.G.A., and T.P. Kavanagh. 1976.
Water and Waste Treatment 19(2):10.

Pollution prevention, Oil-water separation, Ballast, Tankers, Estuaries, UK, North Sea

Methods of preventing oil pollution and separating oil from water are discussed with reference to North Sea oil and the United Kingdom. Ballast water discharge from tankers in and around estuaries is reviewed and possible prevention methods are suggested.

C-2084-76
ANNULAR TYPE BLOWOUT PREVENTER
Williams, B.C. 1975.
U.S. Patent Application B 541,710

Blowout prevention, Design and engineering, Drilling

"An annular blowout preventer is described wherein a number of flexible bands is arranged about the packer within the recess about the bore through the preventer housing. Means are provided for moving the bands toward and away from the bore so as to selectively contract the packer into sealing engagement about an object in the bore or upon itself when the bore is empty or permit the packer to expand into the recess."

[from Petroleum Abstracts 10(25):#220,746. 1976]

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

C-2085-76
No title given (news brief)
Anon. 1976.
BioScience 26(6):418.

Biological effects, Marine mammals, Birds, Arctic, Alaska, *Walrus

NOAA has awarded a new contract to Johns Hopkins University's Dept. of Pathobiology to study the possible effects of oil pollution on the Arctic walrus. Remote sensing techniques will be used to track and monitor walrus activities. Another grant has been awarded to the University of Wisconsin to study the environmental impacts of oil activities on some 40 species of birds in the Pribilof Islands area, with emphasis on herring gulls as environmental indicators.

C-2086-76
EFFECTS OF SALINITY AND SELECTED PETROLEUM HYDROCARBONS ON THE OSMOTIC AND CHLORIDE REGULATION OF THE AMERICAN OYSTER *CRASSOSTREA VIRGINICA*
Anderson, R.D., and J.W. Anderson. 1975.
Physiological Zoology 48(4):420-430.

Biological effects, Crude oil, Fuel oil, Mollusks, *Oysters, *Osmoregulation

Oysters were examined for their ability to osmoregulate after transfer to different salinities and exposure to aqueous dispersions of No. 2 fuel oil and Louisiana Crude. The oils were found to have few, if any, nonreversible or long term effects on osmoregulation and chloride regulation in the oysters.

C-2087-76
ON THE INTERACTION OF POLYCYCLIC AROMATIC HYDROCARBONS AND LIGHT WITH REGARD TO SYNCARCINOGENIC EFFECTS [English summary]
Bauer, L., W. Graef. 1976.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektions-krankheiten und Hygiene, Abteilung 1: Originale, Reihe B 161(4):304-316.

Toxicity, PAH, Carcinogens, *Phototoxicity

The phototoxicity of several polycyclic aromatic hydrocarbons upon illuminated cultures of *Tetrahymena pyriformis* was experimentally determined. None of the hydrocarbons studied produced toxic effects in the non-illuminated control cultures at concentrations $\leq$ 200 ppb. Under illumination, however, carcinogenic benzo[a]pyrene was toxic even in dilutions of 2 ppb.

[from Chemical Abstracts 84(25):#174884s. 1976]

C-2088-76
AN OIL SPILL IN AN ALPINE HABITAT
Belsky, J. 1975.
Northwest Science 49(3):141-146.

Biological effects, Oil spills, Plants, Washington, *Alpine habitat

Results of a study to assess the vegetation of damage caused by a spill of 26,500 1 (7,000 gal) of diesel fuel into an alpine meadow near Mt. Baker, Washington, are presented. Most herbaceous plants in the *Carex nigricans* and *Phyllodoce empetriformis*-*Cassiope mertensiana* associations were killed; woody species were severely damaged but survived the effects of the spill. The root systems of the plants escaped major damage.

[from Environmental Health and Pollution Control 9(10):#2404. 1976]

C-2089-76
SURVEY OF MARINE COMMUNITIES IN PANAMA AND EXPERIMENTS WITH OIL
Birkeland, C., A.A. Reimer, and J.R. Young. 1976.
Final report EPA/600/3-76/028. 191p.

Biological effects, Marine organisms, Fuel oil, *Panama

The effects of oil pollution on tropical marine communities on the coasts of Panama were tested in controlled experiments using Bunker C and diesel oils. Baseline surveys were conducted.

[from Government Reports Announcements 76(16):#PB-253409/7GA. 1976]

C-2090-76
CHANGES OF THE PARAFFINIC AND NAPHTHENIC HYDROCARBON AS WELL AS THE 3,4-BENZOPYRENE CONTENT IN MUSSELS FROM A COASTAL ZONE POLLUTED BY A FUEL SPILL [in French]
Bories, G., J. Tullies, J.C. Peltier, and R. Fleckinger. 1976.
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie D. 282(17):1641-1644.

Biological effects, Hydrocarbons, Mollusks, *Hydrocarbon metabolism, *Mussels

"Mussels (*Mytilus edulis*) were heavily contaminated by paraffin and naphthene hydrocarbons following a fuel spill. Saturated acyclic hydrocarbons were metabolized more rapidly than other types of hydrocarbons. 3,4 Benzopyrene was detected in the mussels up to 11 days after the pollution."

[from Chemical Abstracts 85(5):#29237y. 1976]

C-2091-76
THE LOSS OF ELECTROLYTES FROM LEAVES TREATED WITH HYDROCARBONS AND THEIR DERIVATIVES
Boyles, D.T. 1976.
Annals of Applied Biology 83(1):103-113.

Hydrocarbons, Toxicity, Plants, *Electrolyte loss

The phytotoxicity of members of a homologous series of hydrocarbons and their oil-soluble derivatives was determined by measuring the loss of electrolytes from the leaves of various plants treated with these compounds. In general, the loss of electrolytes was found to increase with increasing hydrocarbon chain length. The effects of dilution, amount of polarity, and viscosity on the toxicity of these hydrocarbons is discussed.

[from Chemical Abstracts 84(25):#174750u. 1976]

C-2092-76
HYDROCARBON METABOLISM IN THE INTERTIDAL FIDDLER CRAB UCA PUGNAX
Burns, K.A. 1976.
Marine Biology 36(1):5-12.

Biodegradation, Biological effects, Hydrocarbons, Crustaceans, *Uca pugnax

The fiddler crab Uca pugnax was examined for its ability to utilize hydrocarbons, particularly those derived from petroleum pollution. It was found that, unlike fish and many other organisms, these crustaceans metabolize contaminant hydrocarbons at very slow rates. Chemical analyses indicated that their metabolism is not sufficiently rapid to oxidize the hydrocarbons within their life spans, and this fact in part accounts for their great sensitivity to oil pollution.

C-2093-76
EFFECT OF DISSOLVED AROMATIC HYDROCARBONS ON THE GROWTH OF MARINE BACTERIA IN BATCH CULTURE
Calder, J.A., and J.H. Lader. 1976.
Applied and Environmental Microbiology 32(1):95-101.

Biological effects, Bacteria, Aromatic hydrocarbons, Toxicity, Microorganisms

The growth rate and maximum cell density of marine bacteria in batch cultures was found to decrease with increasing concentrations of dissolved aromatic hydrocarbons. Toxicity levels were observed to increase inversely with solubility, and partial oxidation of naphthalene caused complete cessation of growth at high concentrations.

C-2094-76
SOME DISSENTING REMARKS ON DELETERIOUS EFFECTS OF COREXIT 9527 ON FERTILIZATION AND DEVELOPMENT
Canevari, G.P., and G.P. Lindblom. 1976.
Marine Pollution Bulletin 7(7):127-128.

Toxicity, Dispersants, Crude oil, *Corexit 9527

The relevancy of laboratory toxicity studies of a chemical oil dispersant is disputed. Laboratory concentrations of the dispersant are not representative of the usual marine environment and there is no evidence to support the belief that chemical dispersants preferentially release toxic substances from the crude oil.

C-2095-76
MARINE POLLUTION BY MINERAL OILS
Caspers, H. (ed.). 1975.
Pollution In Coastal Waters. Germany, Deutsche Forschungsgemeinschaft, 1975. p.103-107.

Toxicity, Analytical techniques, Chromatography, Fishes, Plankton, Algae

Current advances in oil pollution research are highlighted. Toxicity tests on fish, plankton, and algae using various techniques including gas chromatography are reported.

C-2096-76
EFFECTS OF OIL POLLUTION ON BREEDING GREY SEALS
Davis, J.E., and S.S. Anderson. 1976.
Marine Pollution Bulletin 7(6):115-118.

Biological effects, Oil spills, Marine mammals, Wales, *Grey seals

Oil stranded on the shores of West Wales in September, 1974, coincided with the start of the Grey Seal breeding season. The effects of the oil pollution on the growth rate, survival, and behavior of seal pups and their mothers were studied over a period of several weeks. In general, the oil pollution appeared to have few adverse effects on the growth and behavior of the nine oiled pups that were studied; however, two pups were so heavily encased by oil that they could not swim and drowned.

C-2097-76
BIOLOGICAL ASPECTS OF TERRESTRIAL OIL SPILLS. USA CCREL OIL RESEARCH IN ALASKA, 1970-1974
Deneke, F.J., B.H. McCown, P.I. Coyne, W. Rickard, and J. Brown. 1975.
Cold Regions Research and Engineering Laboratory Report 346. vii + 66p.

Oil spills, Natural seepage, Arctic, Biological effects, Plants, Restoration, Alaska

Biological effects of petroleum products upon arctic and subarctic terrestrial plant communities were studied in order to define the most sensitive ecosystems, quantify and understand injury responses, and establigh time frames for recovery and restoration. To accomplish these objectives, surveys of natural seepages and past accidental spills from pipelines and other sources, experimental spills, and laboratory studies were conducted. Results indicate that all plant communities are injured but to varying degrees. Severity of damage is greatest when root systems are saturated. Rates of recovery vary with season and soil moisture content, and recovery can be aided by the use of fertilizers that stimulate plant growth and microbial degradation of oil.

C-2098-76
EFFECTS OF WATER SOLUBLE COMPONENTS OF CRUDE OIL ON THE FECUNDITY OF THE COPEPOD TIGRIOPUS JAPONICUS
Finney, C., and A. D'Agostino. 1976.
U.S. National Bureau of Standards Material Resources Symposium, 8th, Gaithersburg, Maryland, 1976. p.63. Abstract.

Biological effects, Crude oil, Crustaceans, *Fecundity, *Copepods

Because harpacticoid copepods of the genus Tigriopus are ubiquitous in the intertidal zone, a habitat especially sensitive to oil spills, their reaction to water soluble components of oil were experimentally determined. Very dilute sublethal concentrations of water soluble oil extracts were found to result in increased fecundity of the copepods.

[from Petroleum Abstracts 16(33):#223,746. 1976]

C-2099-76
TOXIC EFFECTS OF OIL DISCHARGED FROM SHIPS
Frankenfeld, J.W., J.J. Elliot, R.E. Bentley, and B.H. Sleight, III. 1975.
Final report, USCG-D-16-76, Contract DOT-CG-51073-A. 142p.

Toxicity, Fishes, Crustaceans, Petrochemicals, Oil discharges

Selected petroleum products were studied to determine their dissolution properties in water. Toxicity tests were conducted on two fish and a brine shrimp using dissolved and dispersed oils in water. The results are critically reviewed and contrasted.

[from Government Reports Announcements 76(11):#AD-A022 902/1GA. 1976]

C-2100-76
CHEMICALLY INDUCED LESIONS IN ESTUARINE OR MARINE TELEOSTS
Gardner, G.R. 1975.
The Pathology of Fishes. W.E. Ribelin and G. Migaki (eds.).
University of Wisconsin Press, 1975. p.657-693.

Toxicity, Crude oil, Fishes, *Teleosts

Toxicity tests were conducted on certain marine teleosts using cadmium, copper, mercury, silver, zinc and methoxychlor, and crude oil. The crude oil produced lesions in the olfactory organs of Menidia menidia.

[from Selected Water Resources Abstracts 9(9):#W76-04045. 1976]

C-2101-76
SPENT MOTOR OIL EFFECTS ON SOIL AND CROPS
Giddens, J. 1976.
Journal of Environmental Quality 5(2):179-181.

Biological effects, Waste oil, Crankcase oil, Soil, Plants

Used crankcase oil was experimentally applied to soil at rates of up to about 31,000 l/ha. in order to determine its effects on soil and plant growth. Peanuts, cotton, soybeans and corn grew and developed successfully on oil-treated soil when amply fertilized, but growth of sorghum and weeds was inhibited by high oil rates. Phosphorus, potassium, calcium, magnesium, and lead content of corn was the same in oil-treated and control plots; control plants contained more nitrogen and manganese.

[from Chemical Abstracts 85(1):#906e. 1976]

C-2102-76
EFFECTS OF CRUDE OIL SPILLS ON AQUATIC VEGETATION IN THE MACKENZIE VALLEY NEAR NORMAN WELLS, N.W.T.
Hellebust, J.A., B. Hanna, M.S. Gergis, and T.C. Hutchinson. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.59-61.

Biological effects, Oil spills, Pipelines, Canada, Plants, Phytoplankton

The title study is a part of a larger program supported by the Department of Indian and Northern Affairs to evalute potential environmental effects of crude oil spills from a proposed pipeline along the Mackenzie Valley and flood plain. Assessment of the effects of crude oil on freshwater phytoplankton and higher aquatic plants along this route is considered significant.

[from Petroleum Abstracts 16(28):#221,971. 1976]

C-2103-76
EFFECT OF FOUR OILS ON COASTAL MARINE MICROBIAL POPULATIONS: A CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Hodson, R.E., F. Azam and R.F. Lee. 1975.
Controlled Ecosystem Pollution Experiment (CEPEX). Washington, D.C., National Science Foundation, 1975. 18 p. Annual Report to the Office of the International Decade of Ocean Exploration, National Science Foundation.

Biological effects, Microorganisms, Crude oil, Fuel oil, Coasts, Canada

The effects of Louisiana and Kuwait crudes, No. 2, and Bunker-C fuel oils on heterotrophic uptake and mineralization of D-glucose by microbial populations from Saanich Inlet, Canada, were examined. All oils inhibited uptake and mineralization, with the two processed oils being more toxic than the crude oils. Populations did not acquire tolerance to oil after one month's exposure.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q3266. 1976]

C-2104-76
INTERACTIONS OF CRUDE OIL AND ARCTIC MICROBIAL POPULATIONS IN OPEN CHEMOSTATS
Horowitz, A., and R.M. Atlas. 1976.
Annual Meeting of the American Society for Microbiology, 76th, Atlantic City, 1976. p.194:#Q21. Abstract.

Crude oil, Microorganisms, Arctic, Monitoring

Petroleum and arctic microbial populations were studied in open-flow chemostats. Microbial populations underlying oil slicks were large and showed sinusoidal fluctuations; whereas the unoiled control chemostats showed a constant mesophilic population that was much lower than the experimental group. Phosphorus and nitrogen additions to the oil showed an increase in population of one order of magnitude over the control group within 10 days.

C-2105-76
PRELIMINARY STUDIES ON THE EFFECTS OF A SIMULATED OIL SPILL ON ARCTIC TERRESTRIAL VEGETATION
Hutchinson, T.C. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.62-64.

Biological effects, Oil spills, Plants, Canada, Arctic

A variety of techniques was used to record the vegetation present before and after simulated oil spills were made in the region of black spruce taiga and muskeg near Norman Wells, N.W.T. (July 1972 and March 1973).

As a result of the spill, it was found that the foliage of many species was killed within a few days. The overall cover and species diversity per unit area were reduced.

[from Petroleum Abstracts 16(28):#221,972. 1976]

C-2106-76
A REGIONAL OIL IMPACT STUDY IN PUGET SOUND, STATE OF WASHINGTON
Jamison, D.W. 1975.
Pacific Science Congress, 13th, 1975. Vancouver, University of British Columbia, 1975. Vol. 1. p 34. Abstract.

Biological effects, Oil spills, Information systems, Resource management, Washington

The impact of oil pollution on Washington's Significant Biological Resources is being investigated. The data will be used to assess any damage resulting from an oil spill and to evaluate oil routes, terminals, and drilling sites. A computerized literature retrieval system will be employed to develop habitat, oil impact, and species fact sheets.

[from Oceanic Abstracts 13(4):#76-03556. 1976]

C-2107-76
INFLUENCE OF ILLUMINATION ON PHYTOTOXICITY OF CRUDE OIL
Lacaze, J.C., and O. Villedon de Naïde. 1976.
Marine Pollution Bulletin 7(4):73-76.

Biological effects, Crude oil, Phytoplankton, Algae, *Photooxidation

After discharge at the water surface, crude oil is rapidly modified by biological and physico-chemical processes such as photo-oxidation. The phytotoxicity of photo-oxidized crude oil to certain microalgae and marine plankton communities was determined by the experimental illumination of fresh, weathered, and chemically dispersed crude oil samples. The toxicity of crude oil extracts increased two to three-fold when the oil was first illuminated at sufficient intensity and duration. The addition of a chemical dispersant such as Corexit 8666 was found to increase the toxicity of the extracts by a factor of about 30.

C-2108-76
ANALYTICAL APPROACH IN THE EVALUATION OF BIOLOGICAL DAMAGE RESULTING FROM SPILLED OIL
LaRoche, G. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington D.C., National Academy of Sciences. Vol. 1. p.346-374.

Biological effects, Chemical effects, Crude oil, Fishes

The study calls for sensitive interdisciplinary evaluation of biological damage resulting from exposure to oil pollutants. In this study, fish exposed to low doses of crude oil or crude oil fractions showed evidence of chemoreceptor and olfactory system damage which would prevent their finding food, escaping predators, or performing normal reproductive functions.

[from Selected Water Resources Abstracts 9(11):#W76-05153. 1976]

C-2109-76
EFFECTS OF OIL ON THE AMPHIPOD GAMMARUS OCEANICUS
Linden, O. 1976.
Environmental Pollution 10(4):239-250.

Biological effects, Crude oil, Crustaceans, *Amphipod

The effects of one crude and two refined oils were studied under various conditions on larvae and adults of the amphipod *Gammarus oceanicus*. Larvae were found to be more sensitive to the oils than the adults when toxicity and bioassay tests were run. The adults showed impaired swimming and light reaction, a decreased tendency to precopulate, and a decreased rate in larvae production.

C-2110-76
DELETERIOUS EFFECTS OF COREXIT 9527 ON FERTILIZATION AND DEVELOPMENT
Lönning, S., and B.E. Hagström. 1976.
Marine Pollution Bulletin 7(7):124-126.

Biological effects, Toxicity, Dispersants, Fishes, Invertebrates, *Corexit 9527

The effects of Corexit 9527, a water soluble oil dispersant, were studied in larvae of several species of sea urchins and marine fishes. Retardation in the rate of sea urchin fertilization and cell differentiation resulted in abnormal larvae. The results of fish studies corroborated data obtained in the sea urchin experiments.

C-2111-76
THE EFFECTS OF AN OIL SPILL ON THE MACROINVERTEBRATES AND FISH IN A SMALL SOUTHWESTERN VIRGINIA CREEK
Masnik, M.T., J.R. Stauffer, C.H. Hocutt, and J.H. Wilson. 1976.
Journal of Environmental Science and Health, Part A A11(4-5):281-296.

Oil spills, Biological effects, Freshwater, Benthos, Fish, Birds, Virginia

Although a fuel oil spill in a small Virginia creek resulted in minimal mortality to benthos and fish, the mortality of waterfowl and water snakes was relatively high. Fish showed no significant decreases in number of taxa or specimens collected at the site of the spill for the duration of the survey. A reevaluation of the use of straw oil containment booms is urged because oil leaching from the straw could cause detrimental effects over a period of time.

[from Chemical Abstracts 85(8):41777g. 1976]

C-2112-76
THE EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON THE EMBRYONIC DEVELOPMENT OF PLATICHTHYS FLESUS LUSCUS PALLAS [English summary]
Mazmanidi, N.D., and T.R. Bazhashvili. 1975.
Gidrobiologicheskii Zhurnal 11(5):56-61.

Biological effects, Toxicity, Petrochemicals, Fishes

The effect of different concentrations of petroleum products upon the rate of heart beat, survival, pigment cell configuration, and percentage of abnormalities at various stages of egg development were studied under laboratory conditions. A concentration of 0.025 mg/l was found to be non-toxic; whereas concentrations of 1.7-2.5 mg/l impededed or slowed hatching.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q3293. 1976]

C-2113-76
THE ENVIRONMENTAL IMPACT OF AN OFFSHORE OIL SPILL
McAuliffe, C.D. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington, D.C., National Academy of Sciences. Vol. 1. p.223a-279.

Oil spills, Biological effects, Environmental effects

The environmental impact of oil spills, with emphasis on their biological effects, is discussed. Parameters such as volume and duration of spill, physical and chemical properties of various petroleum products, water temperature, and wind, wave and current conditions are considered.

C-2114-76
EFFECT OF SEA POLLUTION (PETROLEUM, DDT, DETERGENTS) ON SEA FLORA [in Polish]
Mowszowicz, J. 1976.
Kosmos (Warsaw) Seria A 25 (1):39-46.

Biological effects, Contaminants, Plants, Oceans

"A review with 8 references."

[from Chemical Abstracts 85(7):#41571k. 1976]

C-2115-76
OIL POLLUTION AND MARINE ECOLOGY IN THE SOUTH-WEST
Nelson-Smith, A. 1975.
Proceedings of the Challenger Society 4(6):267.

Biological effects, Oil spills, Marine organisms, UK

A decline in the number of topshells, changes in barnacle dominance, and reduced numbers of Littorina neritoides are probably due to oil pollution on the south-east coasts. Other faunal changes are described in relation to the type of oil spilled.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q3309. 1976]

C-2116-76
OIL AND ARCTIC MARINE INVERTEBRATES
Percy, J.A. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.71-74.

Toxicity, Marine organisms, Invertebrates, Arctic, Canada

Acute and chronic toxicity determinations are being conducted in order to detect the direct effects of oil on marine estuarine fauna of the west Arctic. Effects of sublethal concentrations of both emulsified oil-and seawater soluble components on feeding, growth, and metabolism of selected species are being studied. Research will initially concentrate on adults of benthic species; emphasis will then shift to planktonic and larval forms.

[from Petroleum Abstracts 16(28):#221,989. 1976]

C-2117-76
ARROW SPILL IS EVIDENT AT CHEDABUCTO (news brief)
Porteous, J. 1976.
National Fisherman 57(4):13A.

Biological effects, Environmental effects, Oil spills, Chedabucto Bay, Restoration

The long term biological and environmental effects of an oil spill at Chedabucto Bay, Nova Scotia, are discussed. In six years since the tanker Arrow went aground and spilled 9.5 million liters (2.5 million gallons), the marine system has recovered fully except for the benthos. Further studies of marine fauna and flora are being conducted in an effort to assess the overall impact of a large oil spill.

C-2118-76
LITTER AND OIL ON THE SHORES OF UTSIRA, ROGALAND COUNTY, DURING AUTUMN 1974 [English summary]
Ree, V. 1975.
Fauna (Oslo) 28(4):185-191.

Birds, Shoreline, Norway, Biological effects, Offshore drilling, North Sea

During an ornithological survey of the shores of Utsira, Norway, a number of oiled seabirds was observed: *Somateria mollissima*, *Uria aalge*, *Alca torda*, *Plotus alle*, *Sula bassana*, *Larus argentatus*, and *L. ridibundus*. Pollution on Norway's coast is getting worse. Utsira is one of the areas that will be affected first in the event of an oil spill in the North Sea.

[from Biological Abstracts 61(11):#63305. 1976]

C-2119-76
TOXICITY OF WATER-SOLUBLE FRACTIONS OF NO. 2 FUEL OIL AND SOUTH LOUISIANA CRUDE OIL TO SELECTED STAGES IN THE LIFE HISTORY OF THE POLYCHAETE, *NEANTHES ARENACEODENTATA*
Rossi, S.S., and J.W. Anderson. 1976.
Bulletin of Environmental Contamination and Toxicology 16(1):18-24.

Toxicity, Fuel oil, Crude oil, Hydrocarbons, Annelids, *Polychaete worms

Water soluble fractions of No. 2 fuel oil and South Louisiana crude oil were tested for their toxicity to four juvenile stages and the adult stage of the polychaete worm, *Neanthes arenaceodentata*. In general, fuel oil-derived solubles are more toxic to the organisms which is attributed to the relatively high concentration of naphthalenes in the fuel oil. Very young stages of the *Neanthes* life cycle exhibit the greatest tolerance to solubles from both oils, and young adult stages appear to be most susceptible to oil spills or other sources of water-soluble hydrocarbons.

C-2120-76
MARINE POLLUTION FROM VESSELS
Sandbrook, R., and A. Yurchyshyn. 1975.
Critical Environmental Issues on the Law of the Sea. R.E. Stein (ed.). Washington, D.C., International Institute for Environment and Development, 1975.

Ships, Tankers, *Oil pollution

This paper focuses on oil pollution as the main form of vessel-source pollution and discusses the related problems.

C-2121-76
POTENTIAL BIOLOGICAL EFFECTS OF HYPOTHETICAL OIL SPILLS OCCURRING IN THE NEARSHORE WATERS OF LONG ISLAND'S SOUTH SHORE
Schrader, B.P., S.F. Moore, B.B. Ackerman, A.D. Long, and L.H. Tower. 1974.
Marine Resources Council, Nassau-Suffolk Regional Planning Board, NY. 217p.

Biological effects, Oil spills, Habitats, New York

Four main parts are included in this study: (1) description of the environment in terms of habitats, (2) analysis of population level responses to oil, especially recovery rates of specific species, (3) analysis of the response of entire habitats to oils, and (4) predictions of the biological effects of hypothetical oil spills.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4349. 1976]

C-2122-76
RESPONSE OF MICROORGANISMS IN ARCTIC TUNDRA SOILS TO APPLICATION OF CRUDE OIL
Sexstone, A.J., C. Winter, and R.M. Atlas. 1976.
Annual Meeting of the American Society for Microbiology, 76th, Atlantic City, 1976. p.194:#Q22. Abstract.

Crude oil, Biological effects, Microorganisms, Soil, Arctic

Prudhoe crude oil was applied to four distinct Arctic tundra soils and variations in microbial populations were measured. Changes in mesophilic hydrocarbon-utilizing microorganisms paralled the changes in total microbial numbers and showed the greatest increases in basin and high-center polygon soils. Changes in subsurface microbial populations were less pronounced than in surface soils. The oil showed downward migration in high-center top and low-center rim soil, but fluctuated in basin and trough soils. Oiled soils did not show significant changes in nitrogen fixation or respiration.

R-2123-76
EFFECTS OF LONG-TERM, LOW-LEVEL EXPOSURE TO OIL
Smith, A.N. 1975.
Petroleum and the Contineneta1 Shelf of North West Europe. H.A. Cole (ed.). Barking, United Kingdom, Applied Science Publishers, 1975. Vol. 2. Environmental Protection, p.105-114.

Biological effects, Contamination, Health hazards, Source identification, Bibliographies

The incidence and sources of low-level oil pollution are reviewed. The biological effects, disturbance of ecosystem, and hazards to humans are discussed. An extensive bibliography is included.

[from Offshore Abstracts 3(1):#76-1514. 1976]

C-2124-76
OIL AND THE CANADIAN ENVIRONMENT
Snow, N.B. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.80.

Oil spills, Freshwater, Biological effects, Benthos, Phytoplankton, Microorganisms, Restoration

In a project conducted by the Freshwater Institute, Fisheries Research Board, two oil spills were carried out in a creek in the Northern Yukon and a small lake in the Mackenzie Delta. The immediate effect of the oil upon zoobenthic organisms, primary productivity by phytoplankton, and microbial populations was monitored along with physical and chemical properties. Both sites have been monitored to estimate rate and nature of their recovery.

[from Petroleum Abstracts 16(28):#221,991. 1976]

C-2125-76
TOXICITY OF NO. 2 FUEL OIL TO COON STRIPE SHRIMP
Vanderhorst, J.R., C.I. Gibson, and L.J. Moore. 1976.
Marine Pollution Bulletin 7(6):106-108.

Toxicity, Fuel oil, Crustaceans, *Shrimp

"Bioassay of a No. 2 fuel oil dispersion with shrimp in a continuous flow system using measured waterborne oil as the indicator of oil concentrations reveals a treatment more definable than those previously described in terms of volume ratios and produces lower lethal concentrations. Shrimp 96-h LC_{50} was 0.8 mg/l in this study as compared to values from 1.5 to 50 mg/l reported for other methods. Mean concentrations in tests do not give significant differences in concentration with respect to day of the test or spatial distribution in the exposure tanks."

C-2126-76
EFFECT OF PETROLEUM AND HYDROCARBONS ON GLUCOSE METABOLISM BY A MARINE PSEUDOMONAS
Walker, J.D. 1976.
Annual Meeting of the American Society for Microbiology, 76th, Atlantic City, 1976. p.175:#N33. Abstract.

Crude oil, Aromatic hydrocarbons, Biological effects, Bacteria

Crude oil, aromatic hydrocarbons, and alkanes were examined at different concentrations in duplicate culture for their ability to effect uptake and mineralization of ^{14}C-U-glucose by Pseudomonas bathycetes. At low concentrations of these compounds a lag phase of 3 to 8 days was observed prior to CO_2 evolution; at high concentrations complete inhibition of glucose uptake and mineralization was observed.

C-2127-76

ENVIRONMENTAL EFFECTS OF OIL EXPOSURE

Wardley-Smith, J. 1975.
Geological Society of London Conference on Petroleum and the Continental Shelf of Northwest Europe, London, 1975. p.65-113.

Biological effects, Environmental effects, Oil spills, Fisheries, Birds, Cleanup

The short and long-term effects of oil on fisheries, shore life, birds, and the tourist industry are discussed. Cleanup procedures on different types of shores vary widely; the overall effects of oil on fauna diversity and abundance require monitoring.

[from Environment Abstracts 6(5):#76-03550. 1976]

C-2128-76

EFFECTS OF OIL DISPERSANTS ON THE DEVELOPING EMBRYOS OF MARINE FISH

Wilson, K.W. 1976.
Marine Biology 36(3):259-268.

Biological effects, Dispersants, Fishes, *Embryonic development

The oil dispersants BP 1002, Finasol ESK, and Corexit 7664 were tested for their effects on the development of herring, *Clupea harengus* L.; plaice, *Pleuronectes platessa* L.; and sole, *Solea solea* (L.). Corexit produced no demonstrable adverse effects on embryonic development at concentrations up to 5000 ppm; the other dispersants resulted in abnormalities in cell division, differentiation, and larval development at concentrations of 5 to 10 ppm.

C-2129-76

WATER SOLUBLE COMPONENTS OF FOUR FUEL OILS: CHEMICAL CHARACTERIZATION AND EFFECTS ON GROWTH OF MICROALGAE

Winters, K., R. O'Donnell, J.C. Batterton, and C. Van Baalen. 1976.
Marine Biology 36(3):269-276.

Toxicity, Fuel oil, Microorganisms, Algae

The toxicity to six types of microalgae of persistent aromatic compounds present in the water soluble fractions of four different fuel oils was compared. The microalgae varied greatly in their response to a given fuel oil type. However, some fuel oils such as Baytown (Texas) or New Jersey were generally more environmentally damaging than others, either by causing selective or enrichment effects on natural populations or by effecting a decrease in total primary production.

C-2130-76

EFFECTS OF A SPILL OF MARINE DIESEL OIL ON THE MEIOFAUNA OF A SANDY BEACH AT PICNIC BAY, HONG KONG

Wormald, A.P. 1976.

Environmental Pollution 11(2):117-130.

Biological effects, Oil spills, Beaches, Invertebrates, China, Restoration, *Meiofauna

The recovery of the meiofauna of littoral sandy beaches in Picnic Bay, Hong Kong was monitored for over 14 months after an oil spill occurred. Nematodes were the first to reappear, but harpacticoids did not return for 8 months. After 11 months normal populations were established; after 14 months larger meiofauna populations were observed.

C-2131-76

PRODUCTION OF EMULSIFYING AGENTS BY BACTERIA AND FUNGI

Zajic, J.E., and C.J. Panchal. 1976.

Annual Meeting of the American Society for Microbiology, 76th, Atlantic City, 1976. p.183:#018. Abstract.

Hydrocarbons, Bacteria, Emulsifiers

Three bacterial species isolated from different sources released lipophilic and hydrophilic emulsifying agents into the medium when grown on hydrocarbon substrates. The emulsifiers obtained in crude form compare favorably with those of some synthetic emulsifiers.

2. ECONOMIC EFFECTS

C-2132-76
EPA: ANTIPOLLUTION PLANT $5.9 BILLION BY 1983 (news brief)
Anon. 1976
Oil and Gas Journal 74(24):49.

Economic effects, Oil industry, Cleanup, Regulations, Pollution prevention

Between 1974 and 1983 the petroleum industry will have to invest about $5.9 billion and spend about $1.9 billion a year to meet government air and water pollution cleanup regulations. According to a new Environmental Protection Agency study, the refining industry will have a net increase in employment of 13,000 workers and if the industry as a whole is growing in 1983, refiners' margins will be high enough to attract capital for new plants. The average product price increase in 1983 is expected to be 1¢/gallon.

C-2133-76
POLLUTION: PAYING FOR THE CLEAN UP COSTS
Anon. 1976.
Petroleum Times 80(2026):31.

Oil spills, Tankers, Cleanup, Economic effects, Dispersants, Toxicity

Improvements in the methods, equipment, and dispersion agents used in cleaning up major tanker spills are called for. It is noted that in some cases the dispersants are more toxic than the oil reaching shore. Case histories are used to illustrate the enormous differences in cost-effectiveness of oil spill cleanup projects. In one example, a specialized team cleaned up a 50,000 ton spill for $360,000; in another case a local team cleared up about 100 tons at a cost of $750,000.

[from Petroleum Abstracts 16(32):#223,465. 1976]

C-2134-76
ENVIRONMENTAL REGULATION AND PUBLIC VALUE
Moskow, M.H. 1976.
The Conference Board Record XIII(4):47-50.

Economic effects, Regulations, Pollution prevention, Government agencies

The article explains and cites examples of the Council on Wage and Price Stability's advisory role in evaluating and ensuring the most cost-effective approaches to environmental protection regulations and programs. For example, the Council recommended that the U.S. Coast Guard shift its emphasis from requiring extensive and costly ship design modifications for oil pollution prevention to strict oil spill liability enforcement as a more cost-effective approach.

3. GENERAL EFFECTS

C-2135-76
REPORT OF WORKING GROUP FOR THE INTERNATIONAL STUDY OF THE POLLUTION OF THE NORTH SEA AND ITS EFFECTS ON LIVING RESOURCES AND THEIR EXPLOITATION
Anon. 1974.
International Council for the Exploration of the Sea, Cooperative Research Report No. 39.

North Sea, Biological effects, *Pollution

Summary not available.

[from Annual Reports on Analytical Atomic Spectroscopy. C. Woodward (ed.). London, The Chemical Society, 1974. Vol. 4:228]

C-2136-76
MARINE ECOLOGY AND OIL POLLUTION
Baker, J. 1976.
Petroleum Times 80(2026):29.

Refineries, Wastewaters, Oil spills, Monitoring, Toxicity, *Research program, England

Oil pollution-related research programs of the Oil Pollution Research Unit of the Field Studies Council, England are reviewed. Biological field surveys, monitoring, and laboratory toxicity studies of oils, dispersants, and refinery effluents are among the research areas. Much of this work is conducted to provide information for industry management and other organizations concerned with the control and treatment of oil spills and industrial effluents.

[from Petroleum Abstracts 16(32):#223,461. 1976]

C-2137-76
JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE POLLUTION (GESAMP)
Berge, G. (Chairman). 1975.
Report of the 7th Session, London, 1975. Intergovernmental Maritime Consultative Organization, 1975. 43p.

Environmental effects, Oil discharges, Offshore exploration

Two sections of this report deal with the "Impact of Oil on the Marine Environment", and "Scientific Aspects of Pollution Arising from the Exploration and Exploitation of the Sea-bed".

C-2138-76
OIL SPILLS
Blumer, M., H.L. Sanders, J.F. Grassle, and G.R. Hampson. 1975.
Energy and Human Welfare-A Critical Analysis: Selection of Papers on Social, Technological, and Environmental Problems of Electric Power Consumption. New York, Macmillan Inf., 1975. Vol 1. p.81-95.

Oil spills, Oil discharges, Wastewaters, Environmental effects

"The overall implications of oil pollution, coupled with the effects of other pollutants, the discharge of oil, chemicals, domestic sewage, and municipal wastes, combined with overfishing, dredging, and the filling of wetlands are analyzed and presented graphically."

[from The Engineering Index Monthly 14(7):#049865. 1976]

C-2139-76
SCIENTIFIC PRESENTATIONS
Bumpus, D.F., et al. 1974.
USBLM Conference on Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast, College Park, Maryland, 1974. 372p.

Hydrocarbons, Environmental effects, Fate, Marine organisms, Pollution prevention

Hydrocarbon transport in ocean water and the uptake and release of hydrocarbons by marine organisms are two of the many topics discussed. The environmental effects of possible oil pollution in the region are described, and recommendations for prevention of marine environmental damage are given.

[from Environment Abstracts 6(5):#76-03548. 1976]

C-2140-76
PRELIMINARY REPORT ON CONTAMINATION OF UNDERGROUND WATER SOURCES BY REFINED PETROLEUM PRODUCTS
Clean Environment Commission, Manitoba. 1976.
Ground Water 14(1):36-44.

Groundwater, Contamination, Oil spills, Storage, Pipelines, Leakage, Canada

The contamination of groundwater supplies by petroleum products from leaking storage facilities, pipelines, spills, and indiscriminate dumping in Manitoba is documented. Vigilance in detecting leaks, preventing spills and prohibiting the dumping of waste oil is called for. Water is rendered unpalatable by oil contamination of 10^{-6} and 10^{-8} by volume, which is well below toxicity levels.

[from WRC Information 3(19):#76-1429M. 1976]

C-2141-76
EFFECTS OF OIL ON BEACHES IN WEST CORK, IRELAND
Cullinane, J.P., and P.M. Whelan. 1976.
Marine Pollution Bulletin 7(4):72-73.

Biological effects, Oil discharges, Ballast, Beaches, Cleanup, Restoration, Ireland

In late October, 1975, nearly 23,000 l of congealed oil, mostly in the form of tar lumps weighing up to 60 kg each and some exceeding 1m in diameter, came ashore on resort beaches on the south coast of Ireland. The oil was believed to be excess ballast pumped by an oil tanker. The beach and coastline cleanup and restoration efforts are described, and the effects of the oil on intertidal and beach fauna and flora are discussed.

C-2142-76
SOME EFFECTS OF A DELIBERATE SMALL SCALE OIL SPILL ON THE OVERLYING VEGETATION AND THE THAW DEPTH NEAR INUVIK, N.W.T.
Dickman, M., and V. Lunardini. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.52-55.

Biological effects, Oil spills, Plants, Canada, Arctic, Physical effects, *Thaw depth

The effect on vegetation and thaw depth of 90 l of crude oil spilled on two plots was noted a year later and compared with natural sites. The vegetation was almost completely dead on the oiled sites, and the oil had reduced the thaw depth under the high hummocks and slightly increased the thaw depth in the heavily vegetated valleys. A hypothesis to explain these results is given.

[from Petroleum Abstracts 16(28):#221,970. 1976]

C-2143-76
POLLUTION OF SOME AREAS OF THE BALTIC SEA LITTORAL BY POLYCYCLIC AROMATIC HYDROCARBONS [English summary]
Gortalum, G. 1975.
Eksperimental'naya i Klinicheskaya Onkologiya (2):95-100.

Biological effects, PAH, Sediments, Marine organisms, Baltic Sea, Analytical techniques

Chromatography and low-temperature luminescence spectrometry were used to measure the concentrations of certain polycyclic aromatic hydrocarbons (PAH) in the Bay of Riga and Bay of Lahepere. Analyses of beach sands, bottom sediments, aquatic plants and animal tissues were conducted, and PAH concentrations of up to 22.4 micrograms per kilogram were reported in bottom sediments of the Bay of Riga.

[from Chemical Abstracts 85(2):#9926u. 1976]

C-2144-76
THE MEDITERRANEAN AND FIGHT AGAINST MARINE POLLUTION CAUSED BY THE PRODUCTION, TRANSPORT AND TRANSFORMATION OF ENERGY AND PRIMARY ENERGETIC MATTER
International Commission for the Scientific Exploration of the Mediterranean Sea. 1975.
Committee for the Fight against Marine Pollution, 2nd Study Days on Marine Pollution, 24th Plenary Congress-Assembly, Monaco, December, 1974.

Hydrocarbons, Environmental effects, Mediterranean Sea

Papers from two sesssions of the International Commission for the Scientific Exploration of the Mediterranean Sea are contained in this volume. Pollution caused by hydrocarbons, thermal wastes, viruses, chemicals, and organic matter are covered.

[from Aquatic Sciences and Fisheries Abstracts 6(3):#6Q2281. 1976]

C-2145-76
WATER POLLUTION RESEARCH
Jenkins, S.H. 1975.
International Conference, 7th, Paris, 1974. New York, Pergamom Press, 1975. Vol. 1,2. 1148p. (Progress in Water Technology, Vol. 7, Nos. 2-6.)

*Oil pollution

Summary not available.

[from Pergamon Press, Sectional Catalog. 1976]

C-2146-76
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME 4. EFFECTS OF CONTAMINANTS
National Oceanic and Atmospheric Administration. 1975.
Report, NOAA-75122904, PB-248, 935/9GA. 72p.

Contaminants, Hydrocarbons, Alaska coast, Environmental effects

"There are 9 papers in the report concerned with the effects of contaminants (oil, hydrocarbons, petroleum, etc.) on the Alaskan coastal waters. Portions of this document are not fully legible."

[from Petroleum Abstracts 16(30):#222,636. 1976]

C-2147-76
MARINE POLLUTION AND MARINE WASTE DISPOSAL
Pearson, E.A., and E. De. Frangipane. 1975.
Proceedings of the International Congress, 2nd, San Remo, Italy, 1973.
New York, Pergamon Press, 1975. 492p. (Progress in Water Technology, Supplement)

Environmental effects, Disposal, Wastewaters, Oceans, *Marine pollution

Papers presented at the second International Congress cover general problems of marine pollution, environmental effects of marine pollutants such as oil, design criteria for marine waste disposal, and experience with marine waste disposal systems.

[from WRC Information 3(28):#76-2014S. 1976]

C-2148-76
ENVIRONMENTAL CHEMISTRY: AIR AND WATER POLLUTION
Stoker, H.S., and S.L. Seager. 1976.
Glenview, Illinois; Scott, Foresman and Company; 1976. 240p.

Contaminants, Environmental effects, Wastewater treatment

Chemical aspects of environmental pollution problems are discussed, with emphasis on the establishment of environmentally acceptable levels of contaminants based on new data or the reinterpretation of previous work. Part II deals with water pollution and includes chapters on oil, detergents, pesticides, toxic metals, and wastewater treatment.

[from WRC Information 3(28):#76-2013S. 1976]

C-2149-76
THE ENVIRONMENTAL LOAD AND CYCLE OF POLYCYCLIC AROMATIC HYDROCARBONS
Suess, M.J. 1975.
International Conference on Environmental Sensing and Assessment, Las Vegas, 1975. New York, Institute of Electrical and Electronics Engineers, Inc., 1976. Vol. 2. p.1 30-4 to 4 30-4.

PAH, Carcinogens, Environmental effects

The formation, degradation and environmental effects of carcinogenic polycyclic aromatic hydrocarbons (PAH) are reviewed. Various natural and manmade PAH sources, such as open burning, heating, power generation, combustion of refuse, and oil and hydrocarbon fuels, are examined.

[from International Aerospace Abstracts 16(11):#25980. 1976]

C-2150-76
REQUIRING POLLUTERS TO PAY FOR AQUATIC NATURAL RESOURCES DESTROYED BY OIL POLLUTION
Wood, L.D. 1976.
Natural Resources Lawyer 8(4):545-609.

Liability, Oil spills, International conventions, Legislation, U.S., *Aquatic resources

A civil liability system which can be used to restore natural resources degraded by oil pollutants and to redress oil pollution injuries to private parties is suggested. The oil pollution problem and its impact on the aquatic environment and human welfare are discussed. U.S. ratification of the IMCO Liability and Fund Conventions and prompt congressional adoption a of comprehensive U.S. system requiring oil polluters to pay for damages to aquatic systems are advocated.

[from Environment Abstracts 6(6):#76-04319. 1976]

C-2151-76
THE SANTA BARBARA CHANNEL: TO BE OR NOT TO BE
Zieglar, D.L. 1975.
Annual AAPG-SEPM-SEG Pacific Sections Meeting, 50th, Long Beach, California, 1975. p.594-612.

Offshore development, Environmental protection, Oil spills, Guidelines, Santa Barbara Channel

The article calls for oil and gas development of the Santa Barbara Channel, and for regulatory and legislative guidelines based on documented safety and pollution data and available oil spill technology rather than emotionalism and simplistic generalizations. The compatibility of carefully managed and guided oil development and environmental protection is stressed.

[from Petroleum Abstracts 16(32):#223,537. 1976]

D. OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL EFFECTS

C-2152-76
ENVIRONMENTAL ASPECTS OF CHEMICAL USE IN WELL-DRILLING OPERATIONS
Anon. 1975.
EPA Conference Proceedings, Texas, 1975. 608p.

Drilling, Oil wells, Contaminants, Environmental effects, Toxicity, Groundwater

Well drilling and its environmental impacts are discussed, and research on toxicity of chemical additives to plants and fish is reviewed. Groundwater contamination from hazardous chemicals used in well drilling is a serious problem that requires careful investigation.

[from Environment Abstracts 6(5):#76-03251. 1976]

C-2153-76
TO TEMPT A PACIFIC EDEN, ONE LARGE OILY APPLE
Brower, K. 1976.
Audubon 78(5):56-68,70,72,74,76,78,80,84-91.

Biological effects. Environmental effects, Offshore development, Ports, Tankers, Pacific Ocean

The possible biological and environmental effects of building a superport for oil tankers in the Palau Islands, Micronesia, are discussed. The history of the concept of developing a "Port Pacific" and adjacent facilities is reviewed, and the current status of the feasibility study is reported.

C-2154-76
WILDLIFE AND OIL SHALE: A PROBELM ANALYSIS AND RESEARCH PROBLEM.
VOL. 1. REPORT
Burke, H.D. 1975.
PB-250-521/2GA. 127p.

Environmental effects, Oil shale development, Wildlife, Habitats

An examination and evaluation of the probable consequences of a developing oil shale industry upon the environment were conducted by nineteen scientists. Regions of Colorado, Utah, and Wyoming were studied with particular emphasis on wildlife and natural habitats.

[from Petroleum Abstracts 16(34):#223,955. 1976]

C-2155-76
WILDLIFE AND OIL SHALE: A PROBLEM ANALYSIS AND RESEARCH PROGRAM.
VOL. 2. APPENDIX
Burke, H.D. 1975.
PB-250-552/OGA. 144p.

Oil shale development, Wildlife, Environmental effects, Water quality, Bibliographies

References that may be used in preparatory studies or in writing proposals are provided. These sources apply to the program of studies, Vol. 1, and include information on aquatic ecosystems, water quality, reptiles and amphibians, wildlife, and arthropods.

[from Petroleum Abstracts 16(34):#223,956. 1976]

C-2156-76
MID-ATLANTIC ZOOPLANKTON. AN OVERVIEW WITH CONSIDERATION OF POTENTIAL IMPACTS BY OFFSHORE OIL EXPLOITATION
Forns, J.M. 1975.
Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast. Estuarine Research Federation Outer Continental Shelf Conference Workshop, 1974. Wachapreague, Virginia, Estuarine Research Federation, 1975. p.277-290.

Biological effects, OCS, Offshore exploration, Atlantic Ocean, Zooplankton

"The potential for adverse biological impacts relating to exploration and exploitation of the Mid-Atlantic Continental Shelf oil supplied [sic] is reviewed and discussed with many references."

[from Chemical Abstracts 85(3):#14735k. 1976]

C-2157-76
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 3: RELATIVE ENVIRONMENTAL RANKING OF PROPOSED OFFSHORE CONTINENTAL SHELF AREAS ON THE BASIS OF IMPACTS OF OIL SPILLS
Kinney, P.J., P.D. Carpenter, M.D. Levine, and S.H. Traver. 1975.
Energy and Environment Series, Contract EPA-68-01-2469. 71p.

Environmental effects, Biological effects, Offshore development, Oil spills, Marine organisms, Birds

"Environmental impacts resulting from offshore oil development are considered for phytoplankton, zooplankton, benthic biota, fish, marine mammals, and birds. Shore related effects are also covered. The relative probability of oil spills occurring because of earthquakes, tsunamis, and severe storms is discussed."

[from Government Reports Announcements 76(11):#PB-25002/3GA. 1976]

2. SOCIAL EFFECTS

C-2158-76
ONSHORE IMPACTS CONFERENCE HELD IN SAVANNAH
Anon. 1976.
The Marine Newsletter 7(4):2.

Socio-economic effects, Environmental effects, OCS, Offshore development

The recently held Onshore Impacts Conference focused on the onshore socio-economic and environmental effects of South Atlantic OCS oil development. The conference discussed both the positive and negative impacts of such development and also explored such topics as the legal framework, intergovernmental relations, and the role of the citizen.

3. ECONOMIC EFFECTS

C-2159-76
COASTAL ZONE: $1.2-BILLION ENERGY IMPACT FUND APPROVED
Anon. 1976.
Science 193(4249):216.

Economic effects, Offshore development, OCS, Coasts, Environmental management

Congress has readied its Coastal Energy Impact Fund which is authorized to disperse about $1.2 billion in funds over the next decade. The funds will encourage coastal zone management and regional planning, and will provide money for public services and facilities in communities that will be impacted by development of OCS oil, gas, and related ports, refineries, and tank farms.

C-2160-76
ENVIRONMENT RULES TO COST REFINERS $6-BILLION BY '83 (news brief)
Anon. 1976.
National Petroleum News 68(7):38-39.

Refineries, Regulations, Economic effects

Petroleum refiners will need to expend about $6-billion between 1974 and 1983 to meet the EPA's air and water-pollution regulations, according to an EPA commissioned report. About $2.7-billion of this total will be spent on control of refinery water-effluent emissions. Conversion to unleaded fuels, lead restrictions, airborne pollutant controls, and residual-oil desulfurization will account for the remaining expenditures.

C-2161-76
ECONOMIC STUDY OF THE POSSIBLE IMPACTS OF A POTENTIAL BALTIMORE CANYON SALE. TECHNICAL PAPER NUMBER 1.
Reinfeld, K.D., and F.F. Callahan. 1975.
Final report, BLM/OCS/NY-75/40.1/ 267p.

Oil-gas leasing, OCS, Atlantic coast, Socio-economic effects, *Onshore impacts

Possible onshore impacts that the potential leasing of the Baltimore Canyon Outer Continental Shelf could have on the Mid-Atlantic coastal region are discussed. Onshore problems that could stem from the proposed sale and factors that could determine the possible socio-economic impacts are evaluated.

[from Government Reports Announcements 76(9):#PB-249 199/1GA. 1976]

4. GENERAL EFFECTS

C-2162-76
OIL SHALE AND ADVANCED RECOVERY
Author unknown. 1976.
American Nuclear Society Conference on Environmental Aspects of Nonconventional Energy Sources, Denver, 1976. p.6-8.

Oil shale development, Environmental effects

Papers on the following topics are summarized: "An Environmental Program for Oil Shale Development" and "The Energy Shortage and Potential Environmental Impacts of Nonconventional Energy Sources".

[from Environment Abstracts 6(6):#76-04109. 1976]

C-2163-76
BEAUFORT SEA OIL DRILLING
Anon. 1976.
Marine Pollution Bulletin 7(5):84.

Offshore drilling, Environmental effects, Beaufort Sea

An environmental study by the Canadian Government shows the Beaufort Sea to be highly susceptible to oil blowouts due to weather conditions and ice freeze-up. Nevertheless, the government may allow exploratory oil drilling in that area.

C-2164-76
FROM ACADEMY REPORTS: ARCTIC OIL AND OFFSHORE PERMAFROST. . .
Anon. 1976.
National Research Council. News Report XXVI (10):5.

Arctic, Offshore development, *Permafrost

This article briefly summarizes a recent (1976) report by the National Research Council's Polar Research Board entitled, "Problems and Priorities in Offshore Permafrost Research." The report noted that little is presently known about subsea permafrost and that offshore permafrost must be taken into consideration in decisions concerning the development, use, and protection of Arctic environments and resources such as oil. The report calls for a comprehensive and vigorous program of research in this area.

C-2165-76
MEDICAL ASPECTS OF NORTH SEA OIL
Anon. 1975.
British Medical Journal 1975(3):576-580; Editorial, p.556.

Oil industry, Offshore production, Health hazards, North Sea,
*Medical aspects

The article summarizes the report, "The Medical Implications of Oil-Related Industry", recently published by the Scottish Council of the British Medical Association. Annual fatality rate for oil rig workers is 2-3 per 1000 (10 times higher than for coal miners), and for oil-related deep sea diving it is 1%. Oil industry links with medical facilities and the responsibilities of the involved governmental departments are explained. The medical needs of offshore workers and the scope of the proposed Institute of Offshore and Environmental Medicine are discussed.

[from International Petroleum Abstracts 4(1):#246. 1976]

C-2166-76
OFFSHORE OIL AND GAS
Anon. 1976.
National Research Council. News Report XXVI (6):1.

Drilling, Offshore production, Design and engineering, Environmental protection, Guidelines

The U.S. Geological Survey has designated the National Research Council's Assembly of Engineering to recommend and help in implementing certification procedures for the environmentally safe design, construction, and installation of fixed and floating offshore platforms.

C-2167-76
OIL SHALE PROGRAM'S EFFECT ON LAND STUDIED (news brief)
Anon. 1976.
Chemical and Engineering News 54(33):24.

Oil shale development, Environmental effects, Inland

Two studies will be conducted by three Colorado universities to examine the environmental effects of oil shale production. Study topics include revegetation of processed oil shale, and trace elements in oil shale areas and what happens to them as these areas are developed. The projects are sponsored by the Energy Research and Development Administration as part of their program to understand the effects of future oil shale development on the environment.

C-2168-76
ROLE OF VIRGINIA'S COASTAL STUDY COMMISSION EXPANDED
Anon. 1976.
The Marine Newsletter 7(4):6.

Environmental management, Coasts, Legislation, Government agencies, Virginia, Offshore development

Virginia's Coastal Study Commission has been directed to assess the State's coastal zone management program (CZM) and to make recommendations especially in the areas of policy and legislation. Major emphasis of Virginia's CZM program is to study and identify possible offshore, interface and onshore effects of the impending OCS oil and gas development.

C-2169-76
SCOTTISH REFINERY AT NIGG POINT
Anon. 1976.
Marine Pollution Bulletin 7(4):62.

Refineries, Environmental protection, Scotland, Contingency planning, Oil spills, Monitoring

Despite strong protests, the UK government has approved the construction of a large oil refinery in northern Scotland. The refinery will be subject to strict environmental protection stipulations which will include a biological pollution monitoring scheme and contingency plans to deal with any oil spills caused by tankers bringing oil from the North Sea and Middle East.

C-2170-76
ENVIRONMENTAL CONSERVATION AND OIL
Baker, J. 1976.
Marine Pollution Bulletin 7(4):77.

Environmental effects, Offshore production, Pollution prevention, Refineries, Monitoring

The proceedings of the Petroleum and Environmental Conservative Symposium. Teheran, April, 1975, are critically reviewed. Published by the International Petroleum Industry Environmental Conservation Association, the symposium report contains papers on impacts of offshore oil operations, pollution prevention in offshore oil operations and in onshore refineries detection, and oil pollution monitoring networks and programs.

C-2171-76
NW EUROPEAN CONTINENTAL SHELF OIL
Baker, J. 1976.
Marine Pollution Bulletin 7(4):76-77.

Offshore production, Environmental protection, Europe, Oil transport, Oil spills, Biological effects

This book review briefly discusses the thirteen papers compiled in the 1975 publication,"Petroleum and the Continental Shelf of Northwest Europe. Vol. 2. Environmental Protection", edited by H.A. Cole. Most papers are syntheses or reviews of such topics as transport and handling of oil, behavior of oil spills, and biological effects of oil pollution. Much of the volume is of special value to newcomers and nonspecialists in the study of oil pollution problems.

C-2172-76
ENVIRONMENTAL IMPACT OF OIL-AND GAS-WELL DRILLING, PRODUCTION AND ASSOCIATED WASTE DISPOSAL PRACTICES
Collins, A.B. 1975.
Geochemistry of Oilfield Waters. Amsterdam, Elsevier Publishers, 1975. P461-475.

Drilling, Oil wells, Environmental effects, Leakage, Wastewater disposal

In this chapter the possible sources of pollution resulting from oil well drilling, such as drilling fluids and muds, well cuttings, well treatment chemicals, corrosion inhibitors and other additives, and crude oil leakage,are reviewed. Various situations under which these materials become pollutants, including blowouts, leakage, poor drilling, production, well abandonment practices, and subsurface disposal, are briefly considered.

C-2173-76
THE EFFECT OF NATURAL PHENOMENA ON OCS GAS AND OIL DEVELOPMENT
Council on Environmental Quality. 1974.
OCS Oil and Gas - An Environmental Assessment, A Report to the President. Washington, D.C., Government Printing Office, 1974. Vol. 3. 195p.

Offshore development, OCS, Oil spills, Atlantic Ocean, Alaska, Gulf of, *Natural phenomena

Tetra Tech was selected to conduct studies to determine the individual and collective oil spill probabilities for physical systems associated with OCS petroleum production, and to define the potential volume of oil that would be released as a result of the effects of natural phenomena. Recommended methods of oil transport and storage for the Atlantic OCS and the Gulf of Alaska are discussed.

[from Oceanic Abstracts 13(2):#76-01876. 1976]

C-2174-76
PRESERVATION OF ENVIRONMENT
Curlin, J.W. 1975.
Energy Awareness Symposium, Knoxville, 1975. p.155-159.

Offshore development, Environmental effects, *States' rights

The development of offshore oil resources is analyzed for its environmental and energy impacts, considering the conflict between states' rights and federal concerns for a uniform approach.

[from Environment Abstracts 6(6):#76-04108. 1976]

C-2175-76
ENVIRONMENTAL REGULATION OF MARINE-BASED ACTIVITIES (NON-VESSEL) IN AREAS OF NATIONAL JURISDICTION
Hallman, R.M. 1975.
Critical Environmental Issues on the Law of the Sea. R.E. Stein (ed.). Washington, D.C., International Institute for Environment and Development, 1975.

Offshore exploration, Offshore development, Oil transport, Storage, Environmental effects

This paper discusses the following issues which are of concern at the Law of the Sea Conference: the effects on the marine environment of oil and gas exploration and development, marine terminal construction, and energy supply facilities (oil storage tanks, pipelines).

C-2176-76
ENVIRONMENTAL IMPLICATIONS OF OIL-SHALE DEVELOPMENT
Kilburn, P.D. 1976.
Environmental Conservation 3(2):101-115.

Oil shale development, Environmental effects, Socio-economic effects, *Piceance Basin

Discussed in this article are the vast oil shale resources in the Piceance Creek Basin in the western United States and the proposed plans to develop this area. The environmental impacts and socio-economic impacts of oil shale development of the Piceance Creek Basin are elaborated.

C-2177-76
COASTAL MANAGEMENT ASPECTS OF OCS OIL AND GAS DEVELOPMENTS
Laroe, E.T., P.R. Stang, K.H. Conroy, D.W. Laist, and T.Q. O'Neill.
1975.
Technical information paper, NOAA-76011504. 89p.

Environmental management, OCS, Offshore development, EIS, Bibliographies

A brief overview of Outer Continental Shelf (OCS) petroleum activities, responsibilities, management and environmental impact statements is provided. An annotated bibliography and a directory of agencies and organizations involved with OCS oil and gas related activities are included.

[from Government Reports Announcements 76(8):#PB-249 751/9GA. 1976]

C-2178-76
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 2: RELATIVE ENVIRONMENTAL ASSESSMENT OF METHODS TO INCREASE ENERGY PRODUCTION, CRUDE OIL, PIPELINE QUALITY GAS, AND ELECTRICITY FROM WESTERN COAL
Levine, M.D., and R.V. Steele. 1975.
Energy and Environment Series, Contract EPA-68-01-2469. 132p.

Environmental effects, Production, Offshore drilling, Contamination

In this report methodology for evaluating relative environmental impacts of alternative ways of producing energy is reviewed. Topics covered include U.S. oil production and enhanced oil recovery, western coal for electricity generation, and offshore drilling and water pollution.

[from Government Reports Announcements 76(11):#PB-250001/5GA. 1976]

C-2179-76
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 4: BACKGROUND PAPERS
Levine, M.D., R.V. Steele, and I.W. Yabroff. 1975.
Energy and Environment Series, Contract EPA-68-01-2469. 132p.

Environmental effects, Social effects, Oil shale development, *Oil pollution

Information relevant to the analysis of environmental tradeoffs among different measures to increase the U.S. energy supply is presented. Social impacts of energy development, air and water pollution, oil pollution, and oil shale development are discussed.

[from Government Reports Announcements 76(11):#PB-250003/1GA. 1976]

C-2180-76
OFFSHORE OIL IMPACTS AND IMPLICATIONS
Marjenhoff, A.J., and D.C. Plate. 1975.
Record of the Seminar on Offshore Oil, The Citadel, Charleston, 1975. Charleston, The Citadel Press. 133p.

Offshore exploration, Offshore development, Socio-economic effects, Environmental effects, Atlantic coast

A seminar was held on October 17, 1975, in Charleston, South Carolina which dealt with oil and gas exploration and development off the South Atlantic coast. A panel of respresentatives of industry, state and federal governments, and environmental interests inquired into numerous onshore and coastal aspects of OCS exploitation including industrial/economic, socio/demographic, environmental, government/legislative, and legal.

C-2181-76
PRE-DRILLING STUDIES UNDERWAY IN BEAUFORT SEA
McNally, R. 1975.
Petroleum Engineer 47(4):99-100.

Offshore drilling, Environmental effects, Beaufort Sea, Biological effects

Described is the Beaufort Sea Environmental Program, a joint industry-government project conducted in the Beaufort Sea prior to beginning exploratory drilling in order to determine the damage to the environment caused by a potential blowout. Intensive work was undertaken in 29 separate studies. The studies were divided into categories covering wildlife, seabirds, and mammals; marine life; existing pollutants; physical oceanography; meteorology; environmental geophysics; sea ice; and oil clean up.

[from Oceanic Abstracts 13(3):#76-02649. 1976]

C-2182-76
BALANCED PROGRAM PLAN: ANALYSIS FOR BIOMEDICAL AND ENVIRONMENTAL RESEARCH. VOLUME 1. OVERVIEW AND SUMMARY
Mitre Corporation Staff. 1975.
Report ERDA-116(Vol. 1.) 200p.

Environmental effects, Oil shale development, *ERDA

An analysis of key environmental problems associated with the development of nine energy technology alternatives, and identification of necessary related health and environmental research areas have been conducted for ERDA's Division of Biomedical and Environmental Research. Oil shale development is one of the technologies considered.

[from Petroleum Abstracts 16(31):#222,964. 1976]

C-2183-76
ENVIRONMENTAL CONSEQUENCES OF ON-SHORE ACTIVITY IN FOUR NEW JERSEY COASTAL COUNTIES RESULTING FROM OFF-SHORE OIL DEVELOPMENT
Narkus-Kramer, J., S. Ratick, and A. Watson. 1975.
Final report, BLM/OCS/NY-75/40.2. 46p.

Environmental effects, Oil-gas leasing, Atlantic coast, New Jersey, *Onshore impacts

"Increases in onshore air and water pollution levels for four New Jersey coastal counties resulting from the proposed Mid-Atlantic oil and gas lease sale (Sale no. 40) were estimated based on the projections of economic activity for 1975,1980,1985, and 1990."

[from Government Reports Announcments 76(8):#PB-249 349/2GA. 1976]

C-2184-76
ONSHORE IMPACTS OF OIL AND GAS DEVELOPMENT IN ALASKA, VOLUME 1
Resource Planning Associates, Massachusetts. 1975.
Report, EPA-68-01-2465. 148p.

Environmental effects, Economic effects, OCS, Alaska, Offshore-development, *Onshore impacts

Both the environmental and economic impacts on Alaska resulting from outer continental shelf as well as onshore oil and gas development will be substantial. Cities will receive varying degrees of these impacts depending on their size and location. "Portions of this document are not fully legible."

[from Government Reports Announcements 76(8):#PB-248 895/5GA. 1976]

C-2185-76
ONSHORE IMPACTS OF OIL AND GAS DEVELOPMENT IN ALASKA. VOLUME II. METHODOLOGY APPENDICES
Resource Planning Associates, Massachusetts. 1975.
Report, EPA-68-01-2465. 162p.

Models, Offshore-development, Alaska coast, *Onshore impacts

An oil and gas development model is analyzed and each of the components is defined. The definitions are then used to make a series of assumptions to map the model onto the area of study to yield development alternatives

[from Government Reports Announcements 76(8):#PB-248 896/3GA. 1976]

C-2186-76
NEARSHORE ENVIRONMENTS OF THE NORTH SLOPE AND THE PETROLEUM INDUSTRY
Schindler, J., and H.J. Walker. 1975.
Report TR-206, Contract N00014-69-A-0211-0003. 14p.

Oil transport, Arctic, Environmental effects, Offshore exploration, Offshore production, Oil industry

The arctic environment is described and oil and gas transport hazards are discussed. Oil exploration and production problems due to ice cover and their possible engineering solutions are also reviewed.

[from Government Reports Announcements 76(15):#AD-A025037/3GA. 1976]

C-2187-76
EFFECTS ON FISHERIES
Shelton, R.G.J. 1975.
Petroleum and the Continental Shelf of North West Europe. H.A. Cole (ed.). Barking, United Kingdom, Applied Science Publishers, 1975. Vol. 2. Environmental Protection. p.75-83.

Environmental effects, Economic effects, Offshore production, Fisheries, North Sea

The possible areas of conflict between the petroleum industry and the fisheries' industry over the highly productive seas between Scotland and Norway are examined. Short and long term effects of offshore development are reviewed.

[from Offshore Abstracts 3(1):W76-1511. 1976]

C-2188-76
AN OIL SPILL RISK ANALYSIS FOR THE MID-ATLANTIC OUTER CONTINENTAL SHELF LEASE AREA
Smith, R.A., J.R. Slack, and R.K. Davis. 1976.
U.S. Geological Survey Open File Report, 76-451. 28p.

Oil spills, Fate, Environmental effects, Offshore development, Atlantic Ocean

In the title study, the probability of oil spills, the likely path of pollutants from spills, and the spatial and temporal distribution of vulnerable recreational and biological resources were analyzed. The risk analysis was conducted as part of a study of the environmental impacts of OCS oil development in the Mid-Atlantic region.

[from Petroleum Abstracts 16(33):#223,741. 1976]

C-2189-76
THE PETROLEUM REFINING INDUSTRY AND ENVIRONMENTAL POLLUTION
Sorkin, Y.G. 1975.
Chemistry and Technology of Fuels and Oils-USSR 11(3-4):286.

Oil industry, Refining, Environmental effects, Oil discharges, USSR

Pollution problems due to high growth rates in the petroleum industry are increasing. New refining processes must be implemented in order to reduce hydrocarbon and crude oil pollutants in wastewaters, rivers, and oceans.

[from Environmental Abstracts 6(5):#76-03256. 1976]

C-2190-76
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 1: SUMMARY OF VOLUMES 2-4.
Stanford Research Institute. 1975.
Energy and Environment Series, Contract EPA-68-01-2469. 29p.

Socio-economic effects, Environmental effects, *Energy development, *Oil pollution

A brief summary of volumes 2 through 4 of the series is presented along with background papers in the following categories: social impacts of energy developments; air and water pollution; and oil pollution and recovery.

[from Government Reports Announcements 76(11):#PB-250 000/7GA. 1976]

C-2191-76
WATER SUPPLY AND ENERGY PRODUCTION IN THE NORTHEAST
Whipple, W., Jr. 1975.
Military Engineer; Journal of the Society of American Military Engineers 67(437):139-142.

Production, Oil industry, Water quality, *Water resources

The energy problems of the Northeast are evaluated against the water resource problem. The petroleum industry and water resources is one of the energy-related topics discussed.

[from Oceanic Abstracts 13(3):#76-02648. 1976]

C-2192-76
OFFSHORE OIL DEVELOPMENT AND THE ENVIRONMENT
Williams, G. et al. 1975.
Geological Society of London Conference on Petroleum and the Continental Shelf of Northwest Europe, London, 1975. p.1-53.

Offshore production, Offshore exploration, Oil spills, Cleanup, Blowout prevention, North Sea

Offshore oil exploration, production, drilling, and oil spill emergency plans are presented with emphasis on North Sea operations. Techniques and types of equipment for blowout prevention and cleanup of oil spills are reviewed. Oil handling practices onshore are also discussed.

[from Environment Abstracts 6(5):#76-03549. 1976]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-2193-76
COMPOSITION FOR THE ELIMINATION OF MINERAL OIL PRODUCTS BY BIODEGRADATION
Inventor unknown. 1975.
British Patent 1,416,274

Oil spills, Seawater, Emulsifiers

"Formulation containing 'vinasse' waste liquor from sugar or amino acid refining, amino acid, fatty acid (e.g. oleic acid) and an emulsifyer claimed to be efficient in accelerating biodegradation of oil in sea water."

[from Industrial Wastes Information Bulletin 6(5):#HMS 6091. 1976]

C-2194-76
EFFECT OF SODIUM STEARATE UTILIZED AS AN EMULSIFYING AGENT ON THE BIODEGRADATION OF CRUDE OIL
Barrilleaux, R.G., and R.B. Bustamante. 1974.
Environmental Engineering and Science Conference, Kentucky, 1974. p.813,815-835.

Crude oil, Emulsifiers, Microorganisms

The effect of sodium stearate, a biodegradable emulsifying agent, on the biodegradation of crude oil is reported. Oil degrading microorganisms are found in small populations in the natural environment due to the lack of nutrients. Sodium stearate provides the necessary chemicals.

[from The Engineering Index Monthly 14(6):#040308. 1976]

C-2195-76
BIODEGRADATION OF OIL ON WATER SURFACES
Bartha, R. 1975.
U.S. Department of the Navy, AD-A-000-722. 13p.

Oil slicks, Cleanup, *Nutrient addition

The biodegradation of oil is increased by applying the essential microbial nutrients, nitrogen and phosphorus, in a form that adheres to the oil and thus stimulates the activity of oil-degrading microorganisms.

[from Industrial Wastes Information Bulletin 7(1):#HMS 6549. 1976]

C-2196-76

HYDROCARBON BIODEGRADATION KINETICS

Button, D. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973.
Washington, D.C., National Academy of Sciences. Vol. 1. p.306a-322.

Oil spills, Microorganisms, Fungi, Bacteria

Biodegradation of oil to carbon dioxide is the final fate of spilled oil except for portions which are somehow preserved from this process. Biodegradation rates are determined by the presence of catalytic enzymes that are produced by biodegrading organisms, chiefly fungal and bacterial populations.

[from Selected Water Resources Abstracts 9(11):#W76-05151. 1976]

C-2197-76

USE OF GENETICALLY-ENGINEERED MULTI-PLASMID MICROORGANISMS FOR RAPID DEGRADATION OF FUEL HYDROCARBONS

Chakrabarty, A.M., D.A. Friello, and J.R. Mylroie. (n.d.).
General Electric Company, Research and Development Center, P.O. Box 8, Schenectady, New York 12301.

Hydrocarbons, Bacteria, Oil spills, Cleanup

The development of a modified *Pseudomonas* strain capable of biologically oxidizing aliphatic, aromatic, terpenic, and polynuclear aromatic hydrocarbons is described. Its application to oil spill cleanup or protein production is discussed.

[from Industrial Wastes Information Bulletin 6(6):#HMS 6238. 1976]

C-2198-76

PETROLEUM HYDROCARBONS INHIBIT DECOMPOSITION OF ORGANIC MATTER IN SEA WATER

Chet, I., and R. Mitchell. 1976.
Nature 261(5558):308-309.

Bacteria, Hydrocarbons, Biological effects, *Chemotaxis

Recent experiments indicate that the ability of marine bacteria to degrade organic matter depends on their chemotactic attraction to the substance, and that such chemotactic response is inhibited by sublethal concentrations of petroleum hydrocarbons. This inhibition of biodegradation was overcome by thorough mixing of the water to bring the bacteria into random contact with the organic substrate, thus showing that the hydrocarbons had not inhibited bacterial enzymatic activity.

[from WRC Information 3(29):#76-2085M. 1976]

C-2199-76
A CONTINUOUSLY RECORDING POLAROGRAPHIC RESPIROMETER AND ITS USE IN OIL BIODEGRADATION STUDIES
Gibbs, C.F. 1976.
Water Research 10(5):443-451.

Seawater, Analytical techniques, *Polarographic respirometer

A continuously recording respirometer is described which is useful in studying the rates of microbial degradation of oil in sea water.

[from WRC Information 3(23):#76-1660S. 1976]

C-2200-76
MICROBIOLOGICAL INVESTIGATIONS OF CRUDE OIL INUNDATED ARCTIC SOILS
Gossen, R., and D. Parkinson. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.56-58.

Crude oil, Arctic, Soil, Fungi

Studies of oil-treated and control soils from 2 study sites in the Mackenzie Delta have revealed that the soil microflora respond in a stimulatory manner to crude oil. Laboratory studies have shown that an Arctic soil fungus, Penicillium janthanellum, inoculated in pure culture into a crude oil salts medium will degrade the entire range of n-paraffins. Using Arctic soil as a source of inoculum, the n-paraffins present in a crude oil-salts medium were completely degraded under anaerobic conditions.

[from Petroleum Abstracts 16(28):221,980. 1976]

C-2201-76
SURVEYS FOR HYDROCARBON UTILIZING BACTERIA IN NORTHWESTERN ATLANTIC COASTAL AREAS
Mulkins-Phillips, G.J., and J.E., Stewart. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.65-70.

Hydrocarbons, Bacteria, Atlantic coast, Sediments, Oil spills, Cleanup

Studies showed that hydrocarbon-utilizing bacteria are ubiquitous in NW Atlantic waters and coastal sediments. The numbers of these bacteria may be an indication of the degree of oil pollution in the areas. Studies on a pure culture of bacteria isolated from Chedabucto Bay and results of the survey work support the view that seeding of oil spills may be ineffective for the cleanup of oil spills.

[from Petroleum Abstracts 16(28):#221,962. 1976]

C-2202-76
CHARACTERIZATION OF THE MICROBIAL COMPONENT OF AN INTERTIDAL SILT-SEDIMENT ECOSYSTEM AT VALDEZ, ALASKA, AND ITS FAILURE TO DEGRADE ADDED CRUDE OIL
Norrell, S.A., and M.H. Johnston. 1976.
Annual Meeting of the American Society for Microbiology, 76th, Atlantic City, 1976. p.194:#Q23. Abstract.

Crude oil, Bacteria, Sediments, Alaska

Carbon-poor and sulfide-free sediment markedly affects the ability of the bacterial populations to degrade Prudhoe Bay crude oil. Usual bacterial populations of about 2300 CFU/gm have been shown to be unaffected by applications of up to 2000 ppm of oil. If the sediment is enriched in situ by algal growth, however, the bacteria respond with an increase in biomass and oxygen uptake. It is concluded that oil and other organic matter are removed by tidal action, since they are unable to penetrate the sediment.

[from Bioresearch Index 12(6):#43150. 1976]

C-2203-76
MICROBIAL DEGRADATION OF OIL SPILLS ENHANCED BY A SLOW-RELEASE FERTILIZER
Olivieri, R., P. Bacchin, A. Robertiello, N. Oddo, L. Degen, and A. Tonolo. 1976.
Applied and Environmental Microbiology 31(5):629-634.

Oil spills, Microorganisms, Crude oil, *Fertilizer

A paraffin supported fertilizer containing $MgNH_4PO_4$ was applied to Sarir crude oil to evaluate the fertilizer's effect on biodegradation of the oil. The slow-release fertilizer stimulated biodegradation, and after 21 days 63% of the oil had disappeared as compared to a 40% reduction in the control area.

C-2204-76
THE RESPONSE OF BACTERIAL POPULATIONS TO ORGANIC POLLUTANTS IN LAKE ONTARIO. THE DEVELOPMENT OF A LABORATORY MODEL INVOLVING OIL DEGRADATION
Pritchard, P.H., and R.M. Ventullo. 1975.
Proceedings of the Rochester Academy of Science 12(4):402-404. Abstract.

Oil slicks, Chemical analysis, Chromatography, Great Lakes

Oil was used in the title study because it contains readily biodegradable components as well as highly recalcitrant hydrocarbons, and it can be analyzed by gas chromatography. In the experiments, an oil slick was simulated and biodegradation rates were monitored for seven to ten weeks, at which time most of the oil had been degraded and the bacterial population depleted. Addition of detergents was found to completely inhibit biodegradation. Use of commercial bacterial seed cultures and isolates from batch cultures resulted in very little degradation.

C-2205-76
OIL DEGRADATION IN SOIL
Raymond, R.L., J.O. Hudson, and V.W. Jamison. 1976.
Applied and Environmental Microbiology 31(4):522-535.

Soil, Monitoring, Plants

The biodegradation of six oils was studied at three widely separated geographical locations to determine the environmental effects of adding petroleum products to field soil. Concentration had decreased significantly from the initial application of the previous year and the rate of degradation did not exceed 2.4 $m^3/4x10m^2$ per month. Plant growth was inhibited and no oil loss was observed via water movement in the soil.

C-2206-76
DENITRIFICATION AND ALKANE OXIDATION BY PSEUDOMONAS AERUGINOSA
Swain, H.M., J.A. Cole, and H.J. Somerville. 1975.
Society for General Microbiology: Proceedings 3(1):10-11.

Hydrocarbons, Bacteria, *Pseudomonas aeruginosa

When Pseudomonas aeruginosa is grown anaerobically with nitrate, octane, and an additional carbon source, the enzymes for octane oxidation are induced. This strain is able to catalyze alkane oxidation and nitrate reduction with a decrease in biomass of the culture.

C-2207-76
PETROLEUM DEGRADATION IN LOW TEMPERATURE MARINE AND ESTUARINE ENVIRONMENTS
Traxler, R.W., and A.M. Cundell. 1976.
Annual Report, No. 98-01-4062-3. 18p.

Hydrocarbons, Microorganisms, Estuaries

Mixed microbial flora from estuarine sources were found to use certain petroleum hydrocarbons. Intracellular deposits similar to those occurring in hydrocarbon-utilizing bacteria and yeast developed in a Penicillium sp. which utilized n-hexadecane. Electron photomicrographs contrast the morphology of hexadecane and peptone-grown fungi.

[from Government Reports Announcements 76(8):#AD-A020 755/5GA. 1976]

C-2208-76
LONG-CHAIN N-ALKANES OCCURRING DURING MICROBIAL DEGRADATION OF PETROLEUM
Walker, J.D, and R.R. Colwell. 1976.
Canadian Journal of Microbiology 22(6):886-891.

Crude oil, Microorganisms

Five axenic cultures and a mixed culture were examined for their ability to degrade various crude oils. A wax was formed during the biodegradation of one of the crudes which was not observed during the weathering of the same oil. The wax contained high-boiling alkanes similar to those formed in tar balls of the open ocean.

[from Petroleum Abstracts 16(33):#223,737. 1976]

C-2209-76
ENVIRONMENTAL FACTORS INFLUENCING THE RATE OF HYDROCARBON OXIDATION IN TEMPERATE LAKES
Ward, D.M., and T.D. Brock. 1976.
Applied and Environmental Microbiology 31(5):764-722.

Hydrocarbons, Lakes, Microorganisms, Crude oil

Hydrocarbon oxidation in 26 Wisconsin lakes was found to vary seasonally with temperature and dissolved nitrogen and phosphorus. Oil degrading microorganisms were found in all lakes and a short lag phase preceded hydrocarbon oxidation upon addition of mineral oil.

C-2210-76
MICROBIAL UTILIZATION OF RAW AND HYDROGENATED SHALE OILS
Westlake, D.W.S., W. Belicek, A. Jobson, and F.D. Cook. 1976.
Canadian Journal of Microbiology 22(2):221-227.

Oil shale, Pollution prevention, Oil shale development, Extraction

Raw and hydrogenated shale oils were experimentally compared for their biodegradability. Whereas raw shale oil was relatively resistant to microbial attack, hydrogenated shale oil was readily metabolized. It is suggested that raw shale oil be reduced at the extraction site before transport in order to facilitate cleanup of possible shale oil spillage.

[from Chemical Abstracts 84(26):#182303r. 1976]

2. PHYSICAL CHANGES OF OIL

C-2211-76
BEHAVIOUR OF CRUDE OIL UNDER FRESH-WATER ICE
Chen, E.C., B.E. Keevil, and R.O. Ramseier. 1976.
Journal of Canadian Petroleum Technology 15(2):79-83.

Crude oil, Spreading, Coalescence, Emulsification, *Freshwater ice conditions

The spreading and behavior of Norman Wells crude oil injected into fresh water under ice was determined experimentally. When injected into still water the oil separates into droplets and rises to the water-ice interface where the droplets coalesce to form a spreading slick. Under turbulent conditions stable oil-in-water and water-in-oil emulsions are formed. The spreading oil does not adhere to the ice undersurface but if the ice continues to grow, alternating lenses and layers of oil and ice are formed.

C-2212-76
VAPOR-LIQUID EQUILIBRIUM OF HYDROCARBONS IN SEA WATER
Cousens, J.D. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D, Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.92-95.

Hydrocarbons, Seawater, *Vapor-liquid equilibrium studies

Studies in vapor-liquid equilibrium of hydrocarbons in seawater are being made at Nova Scotia Technical College. The goal of this program is to predict the residual solubilities of the toxic materials, in particular the aromatic fractions of petroleum.

[from Petroleum Abstracts 16(28):#221,992. 1976]

C-2213-76
KINETICS OF PETROLEUM PRODUCT VOLATILIZATION FROM WATER [English summary]
Grünwald, A. 1975.
Vodni Hospodarstui B 25(10):278-280.

Evaporation, *Petroleum products

"The author discusses the volatilization of some petroleum products from water. Laboratory tests have shown that the volatilization rate of these substances fits the first-order equation of formal kinetics."

[from WRC Information 3(28):#76-1965. 1976]

C-2214-76
A STUDY OF THE SOLUBILITY OF OIL IN WATER
Lu, B.C.Y., and J. Polak. 1976.
Environment Canada, Environmental Protection Service, Technology Development Report EPS-4-EC-76-1. 32p.

Solubility, Hydrocarbons, Fuel oil, Crude oil

Results of experiments measuring the total solubility of various oils in water are reported. Maximal solubilities and the time in which these were attained were found to be 7.5 ppm in 5 days for No. 2 fuel oil, 2.3 ppm in 2 days for medium bunker oil, and 46 ppm in 8 days for western crude oil. A study of the rates of removal of dissolved components indicated traces of soluble hydrocarbons remaining for at least 13 days after their introduction.

[from WRC Information 3(22):#76-1635S. 1976]

C-2215-76
INTERFACIAL BEHAVIOR OF OIL UNDER ICE
Mackay, D., M. Medir, and D.E. Thornton. 1976.
Canadian Journal of Chemical Engineering 54(1-2):72-74.

Physical effects, Oil spills, Arctic, Spreading, *Oil under ice

This study is concerned with the behavior of oil under ice, with emphasis on the oil/ice/water interfacial tension forces and their effects on the spreading and thickness of oil films trapped under ice cover. Data from this study will be useful for relating under-ice oil spills to estimates of their environmental effects and for devising appropriate cleanup and recovery systems.

[from Petroleum Abstracts 16(22):#220,233. 1976]

C-2216-76
PARTITIONING OF HYDROCARBONS BETWEEN THE ATMOSPHERE AND NATURAL WATERS
McAuliffe, C.D. 1973.
Background Papers for a Workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment, Airlie, Virginia, 1973. Washington. D.C., National Academy of Sciences. Vol. 1. p.279a-290.

Hydrocarbons, Evaporation, Oceans

After discharge of oil onto a water surface, the lower molecular weight hydrocarbons ($\leq$ 15 carbon atoms) tend to evaporate quickly into the atmosphere, depending on the water temperature, wave, wind and current action, and the type of petroleum product. The predicted worldwide distribution of hydrocarbons between the atmosphere and natural waters (primarily oceans) is discussed.

[from Selected Water Resources Abstracts 9(11):#W76-05149. 1976]

C-2217-76
ADSORPTION OF BINARY LIQUID-PHASE HYDROCARBON MIXTURES ON ARCTIC TERRAIN
Moore, J.P., C.R. Phillips, and A.S. Tombalakian. 1976.
Canadian Journal of Chemical Engineering 54(1-2):75-80.

Hydrocarbons, Arctic, Soil, Adsorption

Adsorption isotherms of various binary liquid hydrocarbon mixtures on arctic terrain composed of moss, detritus, and clay were found to fit Freundlich isotherm patterns. The degree of adsorption was found to be directly related to the organic content of the terrain; the higher weight hydrocarbons were preferentially adsorbed.

[from Petroleum Abstracts 12(22):#220,234. 1976]

C-2218-76
EVAPORATION OF OIL FROM SLICKS
Nagy, E. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.112-117.

Evaporation, Oil slicks, *Empirical formulas

Empirical formulas were developed to calculate the initial evaporation losses from thin oil layers. Losses during the first hour of exposure are related to temperature, wind velocity, oil layer thickness, and to some extent the amount and volatility of the low-boiling oil fractions. The formulas allow prediction of evaporation losses from specific oils within 10%.

[from Petroleum Abstracts 16(28):#221,960. 1976]

C-2219-76
WATER-IN-OIL EMULSIONS
Nagy, E. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.107-111.

Emulsification, Crude oil, Fuel oil, Oil slicks

This paper describes an investigation of the formation of mousse-type emulsions as a function of temperature, agitation time, and intensity. Crude oil did not form emulsions below a threshold of agitation intensity however, No. 6 fuel oil formed emulsions on very gentle agitation after a sufficient amount of time and under low temperature conditions. Future work is aimed at relating laboratory conditions of agitation with mixing intensities acting on an oil slick on water.

[from Petroleum Abstracts 16(28):#221,986. 1976]

C-2220-76
COASTAL ENVIRONMENTS AND OIL SPILL RESIDUES IN CHEDABUCTO BAY, NOVA SCOTIA
Owens, E.H., and M.A. Rashid. 1976.
Canadian Journal of Earth Sciences 13(7):908-928.

Restoration, Weathering, Sediments, Fates, Oil spills, Canada, Chedabucto Bay

Three years after the 1970 oil spill from the tanker Arrow in Chedabucto Bay, Nova Scotia, natural processes have restored those beach areas exposed to high wave energy. In low-energy, sheltered areas the oil has undergone little change and is still present in the littoral zone. Removal of contaminated sediments in exposed beach areas has resulted in a permanent retreat of the beach crest in areas of limited natural sediment replenishment.

C-2221-76
A TREATMENT OF THE EQUILIBRIUM OF OIL LAYER ON WATER FLOW
Tamiya, S., H. Kato, Y. Watanabe, and T. Komura. 1974.
Japan Shipbuilding & Marine Engineering 8(3):15-21.

Leakage, *Oil layer, *Flowing water

A study of the equilibrium of an oil layer on flowing water in low and high velocity regions is presented. A short description is given of the critical stream velocity for the leakage of oil as well as necessary corrections for the flow velocity.

[from Environmental Health and Pollution Control 9(3):#743. 1976]

3. CHEMICAL CHANGES OF OIL

C-2222-76
INFRARED SPECTRA OF PETROLEUM WEATHERED NATURALLY AND UNDER SIMULATED CONDITIONS
Ahmadjian, M., C.D. Baer, P.F. Lynch, and C.W. Brown. 1976.
Environmental Science and Technology 10(8):777-781.

Weathering, Source identification, Spectroscopy, Narragansett Bay

Sixty different oils were weathered in confined areas under natural and simulated conditions in Narragansett Bay. The weathering was found to alter the infrared fingerprints of the oils. Using artificial weathering techniques it was possible to match oils from actual spills with those weathered artificially.

4. GENERAL FATE OF OIL

C-2223-76
ENVIRONMENTAL CHEMISTRY. VOL. 1
Anon. 1975.
London, The Chemical Society, 1975. 199p.

Oil transfer, Decomposition, Toxicity, Freshwater, Seawater

This volume reviews the cycling of organics such as oils, pesticides, and herbicides in rivers, lakes, bogs, swamps, oceans, and fjords. Physical and chemical mechanisms of transfer, degradation, adsorption and toxic effects are discussed.

[from Industrial Wastes Information Bulletin 6(5):#HMS 6199. 1976]

C-2224-76
OIL AND THE ST. LAWRENCE ESTUARY: UNIVERSITE DU QUEBEC PROGRAM
Drapeau, G. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.96-97.

Oil slicks, Fate, Estuaries, Canada, St. Lawrence River

Oil spill experiments conducted by the Universite du Quebec on the Saint Lawrence Estuary have demonstrated that the displacement of oil slicks is very intricate in these waters. It cannot be predicted by physical or mathematical models and requires further field work. The fate of oil ingested by zooplankton and the sedimentation of particle-loaded oil droplets are being studied.

[from Petroleum Abstracts 16(28):221,979. 1976]

C-2225-76
FATE OF CRUDE OIL SPILLED ON SEAWATER CONTAINED IN OUTDOOR TANKS
Gordon, D.C.,Jr., P.D. Keizer, W.R. Hardstaff, and D.G. Aldous. 1976.
Environmental Science and Technology 10(6):580-585.

Monitoring, Crude oil, Seawater, Sediments, Oil tanks, Spectroscopy

Oil concentrations in the surface film, water column, and sediment were monitored for three months by fluorescence spectroscopy. The concentration of oil in the water column was 2-3 mg/l during the first few days and about half the spilled oil formed tar balls or was stranded on the walls of the tank. Oil was still detected in the seawater and sediment after three months.

C-2226-76
FATE OF OIL SPILLS AND THE SITING OF CANADIAN SUPERTANKER PORTS
Harrison, W. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.16-17.

Fate, Oil spills, Bahamas, Environmental effects, Offshore development, Ports

Studies of the physical and chemical fate of crude oil spilled in the Bahamas have resulted in a methodology for ranking the environmental suitability of potential supertanker port sites in this area. The method includes consideration of winds, currents, and wavefields in port site decisions, construction of slick-drift roses for extreme wind and current conditions, and examination and study of controlled spills of crude oil of the type which is expected to be imported.

[from Petroleum Abstracts 16(28):#221,966. 1976]

C-2227-76
SOURCES OF CONTAMINATION, AMBIENT LEVELS, AND FATE OF BENZENE IN THE ENVIRONMENT
Howard, P.H., and P.R. Durkin. 1974.
Report, EPA-560-5-75-005, PB-244-139. 73p.

Monitoring, Hydrocarbons, Wastewaters, Industries, *Benzene

Benzene losses from commercial production, use, and vehicle emissions are considered. Over half of the total amount released to the environment results from motor vehicle emissions. Evidence suggests that benzene degrades very slowly.

[from Industrial Wastes Information Bulletin 7(1):#HMS 6545. 1976]

C-2228-76
SESSILE ANIMALS, ON TAR GLOBULES IN THE WATERS AROUND THE RYUKYU ISLANDS [English summary]
Kajihara, T., Y. Ura, and M. Tachibana. 1975.
Journal of the Oceanographical Society of Japan 31(3):131-135.

Tar, Japan/Sea of, *Sessile animals

A large number of tar globules with sessile organisms, including bryozoans, tubeworms, and goose barnacles, was found in surface tows around the Ryukyu Islands. The high specific gravity of large attached goose barnacles is believed to result in the sinking of tar globules.

[from Underwater Information Bulletin 8(2):#7604/1309. 1976]

C-2229-76
POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER
Lewis, W.M. 1975.
Water Treatment and Examination 24(4):243-277.

PAH, Hydrocarbons, Contamination, Rivers, UK, *Potable water

"A review of the literature is presented on the studies of occurrence of aromatic hydrocarbons in potable water supplies; water pollution by hydrocarbons; isolation, identification and evaluation of polynuclear aromatic hydrocarbons; and hydrocarbon surveys of various rivers in Great Britain. 27 references."

[from The Engineering Index Monthly 14(4):#028379. 1976]

C-2230-76
PREDICTED OIL SLICK MOVEMENT FROM VARIOUS LOCATIONS OFF THE NEW JERSEY/DELAWARE COASTLINE
Lissauer, I.M., and J.C. Bacon. 1975.
Final report, AD-A019019, CGR-DC-13/75; USCG-D-137-75. 132p.

Oil spills, Movement, Offshore development, Ports, New Jersey, Delaware

The possible movements and contact points of oil spills along the shoreline of New Jersey and Delaware were determined. Current patterns, wind speed, and direction were used to project oil slick movement.

[from Scientific and Technical Aerospace Reports 14(15):#N76-24774. 1976]

C-2231-76
PRELIMINARY PROJECTIONS OF OIL SPILL MOVEMENT FOR THREE POTENTIAL DEEPWATER PORT SITES IN THE GULF OF MEXICO
Lissauer, I.M., and J.P. Welsh. 1975.
Final report, CGR/DC-34/75, USCG-D-19-76. 34p.

Oil spills, Movement, Mexico/Gulf of, Offshore development, Ports

Projections of the movement of oil slicks and their impact location along the shorelines of the Gulf Coast states were determined from three potential deepwater port sites. Average monthly current patterns, wind speeds, and wind directions were used in making these predictions.

[from Government Reports Announcements 76(14):#AD-A024381/1GA. 1976]

C-2232-76
CHEVRON MAIN PASS BLOCK 41 OIL SPILL; CHEMICAL AND BIOLOGICAL INVESTIGATIONS
McAuliffe, C.D. 1975.
Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast, 1974. L.E. Cronin (chairperson). Wachapreague, Virginia, Estuarine Research Federation, 1975. p.185-197. Proceedings of Estuarine Research Federation Outer Continental Shelf Conference and Workshop.

Oil spills, Dispersants, Fate, Mississippi River, Biological effects

In 1970, 65,000 barrels of crude oil and 2,000 barrels of chemical dispersants entered the sea near the Mississippi River Delta. The fate of the oil including evaporation, recovery, biodegradation, dispersion, solution, emulsification, sinking, and photo-oxidation was examined. Benthic samples showed no adverse effects from the oil, nor did shrimp trawls, blue crabs or fish.

C-2233-76
OIL-IN-COLD-WATER RESEARCH AT NOVA SCOTIA TECHNICAL COLLEGE
McLean, A.Y. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.104-106.

Oil spills, Fate, Arctic, Weathering, Cleanup, Source identification

As a result of the oil pollution incident following the wreck of the tanker "Arrow" in Chedabucto Bay, 1970, a research program was begun at Nova Scotia Technical College to investigate the way in which the composition of oil and the physical properties change after a spill in a low temperature environment, and how these changes affect the operation of cleanup equipment. The use of gas chromatography to detect the sources of oil pollutants is also being studied.

[from Petroleum Abstracts 16(28):#221,973. 1976]

C-2234-76
PERSISTENCE OF PETROLEUM HYDROCARBONS IN THE INTERTIDAL BEACH ZONE
Pierce, R.H.,Jr., and R.W. Traxler. 1975(?)
American Chemical Society, 27th Southeast-31st Southwest Regional Meeting, 1975(?). Abstract no. 134.

Oil spills, Hydrocarbons, Sediments, Estuaries, Rhode Island, Biodegradation

The persistence, chemical changes and fate of petroleum hydrocarbons remaining in intertidal, estuarine sediments after an oil spill into Narragansett Bay, Rhode Island, were studied for over a year. Branched and cyclic alkanes were the most persistent hydrocarbons. In mid-tidal sediments, biodegradation and physical degradation accounted for a gradual, nearly total removal of hydrocarbons; whereas in the low-tide sediments the higher weight hydrocarbons persisted.

[from Pollution Abstract 7(3):#76-02311. 1975]

C-2235-76
THE ENVIRONMENTAL FATE OF SELECTED POLYNUCLEAR AROMATIC HYDROCARBONS
Radding, S.B., T. Mill, C.W. Gould, D.H. Liu, and H.L. Johnson. 1976.
Final report, EPA/560/5-75/009, Contract EPA-68-01-2681. 131p.

Fate, PAH, Environmental effects, *Sources, *Transport

The recent literature on polynuclear (polycyclic) aromatic hydrocarbons (PAH) is reviewed. The sources, transport, and the chemical, physical and biological properties of PAH are discussed.

[from Government Reports Announcements 76(11):#PB-250948/7GA. 1976]

C-2236-76
RESEARCH ON LAND BASED OIL SPILLS IN THE CANADIAN NORTH
Riddick, J. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.25-27.

Fate, Oil spills, Inland, Canada, Biodegradation, Weathering

Work sponsored by the Arctic Land Use Research Program of the Department of Indian Affairs and Northern Development is described. The field work is conducted at Norman Wells, N.W.T. and includes studies of microbiological, chemical, and physical aspects of oil behavior in northern environments.

[from Petroleum Abstracts 16(28):#221,969. 1976]

C-2237-76
STUDIES ON THE COMPOSITION AND AGING OF MARINE TARS
Schink, D.R., L.M. Jeffrey, C.W. Poag, R.D. Grigsby, and J.R. Gormly. 1974.
Final report, USCG-D-9-76, CGR/DC-30/75. Contract DOT-CG-23188-A. 103p.

Weathering, Tar, Chemical analysis, *Fouling organisms

Bunker C fuel oil was the only petroleum product to form tar-like material in an experimental aging test of six petroleum products. Marine tar analysis demonstrated the value of separating tar components and analyzing the fractions separately. Iron present in some of the fractions strongly supported the hypothesis that man's activities are involved in their formation. Fouling organisms were an important agent in removing tar from the sea surface.

[from Government Reports Announcements 76(11):#AD-A022 882/5GA. 1976]

C-2238-76
OIL POLLUTION RESEARCH GROUP OF THE INLAND WATERS DIRECTORATE ENVIRONMENT CANADA
Scott, B.F., W.A. Adams, R. Chatterjee, E.C. Chen, A.R. Davis, et al. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.28-31.

Fate, Oil slicks, Movement, Remote Sensing, Canada, *Oil-ice interaction

The Research Group is investigating oil pollution in cold environments with emphasis on water quality, fate of oil, remote sensing and prediction of oil-ice interaction movement. Described are laboratory studies of refined and crude oils, field studies of oil on water under ice-forming conditions, oil effects on spring breakup, remote sensing, and oil-ice movement.

[from Petroleum Abstracts 16(28):#221,987. 1976]

C-2239-76
BEHAVIOUR OF OIL UNDER CANADIAN CLIMATIC CONDITIONS - I. OIL AND WATER UNDER ICE-FORMING CONDITIONS
Scott, B.F., and R.M. Chatterjee. 1975.
Canada Inland Waters Branch Scientific Series 26:15.

Weathering, Chemical analysis, Chromatography, Spectroscopy, Environmental effects

Gas chromatography, infrared, ultraviolet, and fluorescence spectroscopy were used to investigate the properties of weathering oil. The environmental effects of such weathering and the biological implications are discussed.

[from The Engineering Index Monthly 14(4):#028422. 1976]

C-2240-76
OPERATIONAL MODEL FOR PREDICTING THE MOVEMENT OF OIL IN CANADIAN NAVIGABLE WATERS
Simons, T.J., G.S. Beal, K. Beal, El-Shaarawi, and T.S. Murty. 1975.
Canada. Department of the Environment, Marine Science Directorate, Manuscript Report Series No. 37. 30p.

Models, Oil slicks, Movement, Canada

A study to develop and evaluate computer prediction of the movement of oil slicks in Canadian navigable waters is reported. Descriptions of computer programs and guidelines for establishing a data bank on the topographies, climatology and tidal currents in different locations are included.

[from Aquatic Sciences and Fisheries Abstracts 6(4):#6Q4323. 1976]

C-2241-76
DISTRIBUTION OF OIL AND BEHAVIOUR OF OIL SPILLS
Smith, J.W. 1975.
Petroleum and the Continental Shelf of North West Europe.
H.A. Cole (ed.). Barking, United Kingdom, Applied Science Publishers, 1975. Vol. 2. Environmental Protection. p.65-73.

Oil spills, Fate, Spreading, Weathering, Biodegradation

Sources of oil in the marine environment are examined and the size of a potential oil spill which may have to be dealt with is estimated. The rate of spreading and the processes of evaporation, photo-chemical oxidation, solution, dispersion, and microbial degradation of oil are reviewed.

[from Offshore Abstracts 3(1):#76-1510. 1976]

C-2242-76
OIL POLLUTION IN COASTAL AND HIGH SEAS AREAS OF THE NORTH ATLANTIC
Walton, A., and E.M. Levy. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973. D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.32-36.

Oil spills, Fate, Chedabucto Bay, Atlantic Ocean, Mediterranean Sea

Studies of the distribution and composition of oil products in the marine environment have been conducted for the past 3 years since the "Arrow" oil spill in Chedabucto Bay. These studies have been pursued in the Gulf of Saint Lawrence and the Halifax-Bermuda section. Additonal surveys have been made in the North Atlantic, from 15°N to 75°N, and in the Mediterranean Sea. A summary of findings is presented.

[from Petroleum Abstracts 16(28):#221,988. 1976]

C-2243-76
COMPUTER MODELING OF OIL DRIFT AND SPREADING IN DELAWARE BAY
Wang, H., J.R. Campbell, and J.D. Ditmars. 1976.
University of Delaware, Final report no. CMS-RANN-1-76. 58p.

Models, Oil spills, Drift, Spreading, Delaware Bay

A computer model was developed for the prediction of oil spill dispersion in Delaware Bay. The effects of waves on drifting and spreading, diffusion coefficients of oils, and wind effects are all accounted for in the model. This study was conducted as a part of Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation

C-2244-76
OCEAN CHEMISTRY PROGRAMS TO STUDY THE DISTRIBUTION AND FATE OF MARINE HYDROCARBONS IN N.E. PACIFIC OCEAN
Wong, C.S. 1973.
Oil and the Canadian Environment Conference, Toronto, 1973.
D. Mackay and W. Harrison (eds.). Toronto University, Institute of Environmental Science and Engineering, 1973. p.130-132.

Fate, Hydrocarbons, Monitoring, Detection, Tar, Biodegradation, Pacific Ocean

In this study to understand the fate of oil, its pathways, and distribution of hydrocarbons in the N.E. Pacific Ocean, activities included baseline studies of tar-lump distribution on surface waters, degradation studies, hydrocarbon detection by gas chromatography and high-pressure liquid chromatography, and estimation of input of petroleum hydrocarbons into the marine environment by the C^{13} isotope technique and radiocarbon dating.

[from Petroleum Abstracts 16(28):#221,956. 1976]

C-2245-76
DISTRIBUTION AND SOURCES OF TAR ON THE PACIFIC OCEAN
Wong, C.S., D.R. Green, and W.J. Cretney
Marine Pollution Bulletin 7(6):102-105.

Source identification, Tar, Pacific Ocean, Tankers, Oil discharges

"Petroleum residues, or tar lumps, are concentrated in the northwestern portion of the Pacific Ocean, particularly in the Kuroshio current system. The source of the tar appears to be tank washings from tankers on the very large Middle East to Japan route. Tar pollutants apparently are discharged by tankers south of Japan, become entrained in the Kuroshio current, and create a plume of contamination which extends downstream for 7000 km across the Pacific."

F. OIL POLLUTION REGULATIONS

1. STATE LEGISLATION

C-2246-76
OIL SPILLAGE REGULATION
Anon. 1974.
1974 BNA Environmental Report 886:0105-0106.

Regulations, Oil spills, Liability, Oregon

The Oregon regulation makes it illegal for oil to be permitted to enter state waters from any source, and it places absolute liability upon the person having control over the oil. It places responsibility for oil containment, collection, treatment and/or removal upon such person and permits the state to charge or file suit for reimbursement of cleanup costs.

[from Selected Water Resources Abstracts 9(11): #W76-05215. 1976]

C-2247-76
REGULATIONS PERTAINING TO OIL SPILLS INTO PUBLIC WATERS
Anon. 1975.
1975 BNA Environmental Report 886:0531-0532.

Regulations, Oil spills, Cleanup, Oregon

To protect the quality of state waters in Oregon, the person responsible for the control of oil spills must immediately take steps to stop the spillage and must then proceed to collect and remove the oil. If oil collection is not feasible, the person must take actions to contain, treat, or disperse the oil. Cleanup must proceed in accordance with the approval of the Department of Environmental Quality.

[from Selected Water Resources Abstracts 9(12): #W76-06071. 1976]

2. U.S. LEGISLATION

C-2248-76
ALASKA OIL POLLUTION REGULATIONS
Anon. 1974.
1974 BNA Environmental Report 706:0621-0622.

Regulations, Oil discharges, Inland, Alaska, *Oiling permits

"The discharge of oil, asphalt, bitumen or residuary products of petroleum onto the lands of Alaska is herein prohibited unless a surface oiling permit has been obtained from the Department of Environmental Conservation". The conditions for issuance of surface oiling permits and penalties for violations are discussed in detail.

[from Selected Water Resources Abstracts 9(12): #W76-06062. 1976]

C-2249-76
CEQ, OIL POLLUTION
Anon. 1976.
Federal Register 41(60):12658.

Legislation, U.S., Contingency planning, Oil spills, *CEQ

The Council on Environmental Quality has established coordination of onscene activities regarding national oil and hazardous substances pollution contingency plan.

[from Environment Abstracts 6(6):80. 1976]

C-2250-76
DEEPWATER PORT ACT (CONFERENCE REPORT ON H.R. 10701)
Anon. 1974.
U.S. House of Representatives, 93rd Congress, 2nd Session, Report No. 93-1605. 60p.

Legislation, Offshore development, Ports, Economic effects

The conference report provides for the resolution of Senate and House disagreement over the Deepwater Port Act which regulates ownership, construction, and operations of deepwater ports. The report contains background information, major requirements and issues, and cost considerations.

[from Selected Water Resources Abstracts 9(10): #W76-04631. 1976]

C-2251-76
EPA, OIL POLLUTION
Anon. 1976.
Federal Register 41(60):12657.

Legislation, U.S., Pollution prevention, *EPA

EPA established a number of miscellaneous amendments regarding oil pollution prevention.

[from Environment Abstracts 6(6):80. 1976]

C-2252-76
INTERVENTION ON THE HIGH SEAS ACT
Anon. 1974.
PL 93-248; 88 stat 8, U.S. Code. Congressional and Administrative News. p 9-12.

Legislation, Pollution prevention, Oil spills, *Navigation

"Whenever a ship collision or other incident of navigation creates a grave and imminent danger of oil pollution to the coastline or related interests of the United States, the Secretary of the department in which the Coast Guard is operating may take such measures on the high seas are necessary to prevent, mitigate, or eliminate that danger."

[from Selected Water Resources Abstracts 9(8): #W76-03606. 1976]

C-2253-76
LEGISLATION FOR OUTER CONTINENTAL SHELF R AND D
Anon. 1975.
U.S. House of Representatives. Sub Committee on Energy Research, Development, and Demonstration--Committee on Science and Technology, July 8-11, 1975. Hearings. p. 833-1721.

Legislation, *Pollution control, Offshore exploration, Oil-gas leasing

Appendix II submitted to the Sub-committee on Energy Research consists of supplements to the Report of the Work Group on OCS Safety and Pollution Control. Appendix III is made up of reports on OCS petroleum operations including issues of safety assurance and pollution control. Appendix V provides additional information on OCS research activities concerning resource assessment, leasing, environmental programs, diving safety, and hydrocarbons in OCS waters.

[from Selected Water Resources Abstracts 9(14): #W76-07355. 1976]

C-2254-76
OIL SPILL LIABILITY BILL ENDORSED, BUT PASSAGE UNLIKELY
Anon. 1976.
Oil and Gas Journal 74(36):67.

Legislation, U.S., Liability, Oil spills, Tankers, Ports

An oil spill liability bill has been approved by the House Merchant Marine Committee, but passage for this year is slim. The bill sets limits on a company's liability for oil spills and sets up a fund to cover the damage exceeding those limits. Tankers and barges would be liable for a maximum of $30 million or $300/vessel ton, and deepwater ports would be liable for up to $50 million.

C-2255-76
OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1975 - PART I, PART II, PART III
Anon. 1975.
U.S. House of Representatives, Ad Hoc Select Committee, Outer Continental Shelf, June 7,18,19 and July 18,19,25. Hearings. p. 1-915.

Legislation, Offshore exploration, OCS, Environmental protection, Environmental effects

The purpose of these hearings was to consider and report to the full House on legislation establishing a national policy for the management of OCS oil and gas, as well as to protect the marine and coastal environment and to amend the Outer Continental Shelf Lands Act.

[from Selected Water Resources Abstracts 9(14): #W76-07356. 1976]

C-2256-76
OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS AND COASTAL ZONE MANAGEMENT ACT AMENDMENTS
Anon. 1975.
U.S. Senate. Committees on Interior and Insular Affairs and Commerce, April 8-9, 1975. Joint Hearings. p. 697-1745.

Legislation, Offshore exploration, OCS, Environmental Management, Environmental effects

The proposed amendments concern leasing policy changes for OCS mineral deposits, principally oil and gas deposits. Major areas of concern are outlined. The report also presents two research studies, the American Petroleum Institute annual report on environmental research for 1975 and the National Advisory Committee on Oceans and Atmosphere report to the Secretary of Commerce regarding ocean engineering.

[from Selected Water Resources Abstracts 9(14): #W76-07354. 1976]

C-2257-76
USA: MARINE POLLUTION
Anon. 1975.
Bulletin of Legal Developments (20):208. Summary.

Legislation, U.S., Liability, Oil spills

"A bill presented to the U.S. Congress on July 9, 1975, entitled the Comprehensive Oil Pollution Liability and Compensation Act of 1975, would establish a comprehensive and uniform system for fixing liability and settling claims for oil pollution damage in U.S. waters and coastlines. It also would implement the 1969 and 1971 Brussels Conventions on liability and an oil pollution damage fund."

[from Oceanic Abstracts 13(3): # 76-02964. 1976]

C-2258-76
UNITED STATES ENVIRONMENTAL LEGISLATION AND ENERGY RESOURCES: A REVIEW
Beard, D.P. 1975.
Geographical Review 65(2):229-244.

Legislation, U.S., Environmental protection, Offshore production, Oil transport, Economics

The article is a review of major interrelationships between recent environmental legislation and energy supply and demand. Included is a brief discussion of changes in offshore oil production and transportation technology resulting from restrictive environmental legislation that was enacted after the Santa Barbara oil spill.

[from Bibliography and Index of Geology 40(5):621. 1976]

C-2259-76
MARINE POLLUTION CONTROL AND MAN-MADE ISLANDS
Butts, S.A.,III. 1975.
North Carolina State University, Sea Grant publication.
No. UNC-SG-75-04. p. 25-44.

Legislation, U.S., Pollution prevention, Offshore drilling, Ports

U.S. and international pollution laws pertinent to man-made islands, which range from floating oil drilling platforms to artificial islands created by dumping of natural materials, are summarized. Emphasis is on U.S. legislation directed toward oil drilling platforms and superports.

[from Petroleum Abstracts 16(21): # 219,846. 1976]

C-2260-76
PETROLEUM REFINING POINT SOURCE CATEGORY (PROPOSED EFFLUENT LIMITATIONS AND GUIDELINES)
Environmental Protection Agency. 1974.
Federal Register 39(202):37069-37070

Regulations, Guidelines, Wastewater treatment, Refineries

This notice is aimed at encouraging the public to make comments concerning proposed amendments to the Petroleum Refining Point Source Category which are put forth pursuant to the Federal Water Pollution Control Act. These amendments will reduce the range size of process factors from 50% to about 10-15%. Effluent limitation guidelines are presented.

[from Selected Water Resources Abstracts 9(10): #W76-04856. 1976]

C-2261-76
THE REGULATION OF DEEPWATER PORTS
Graham, K.A. 1975.
Virginia Journal of International Law 15(4):927-957.

Legislation, U.S., Ports, Oil transfer, Economic effects, Environmental effects

The Deepwater Port Act of 1974 (DPA) is evaluated from environmental and federal vs. state regulatory perspectives. The advantages and disadvantages and the economic and environmental side effects of deepwater ports for crude oil transfer are examined.

(from Selected Water Resources Abstracts 9(15): #W76-07813. 1976]

C-2262-76
DEEPWATER PORT ACT OF 1974
Louisiana State University Law Center. 1975.
Louisiana Coastal Law, LCL Report 19. 4p.

Legislation, Offshore development, Ports, Liability, Oil spills, Tankers

The Deepwater Port Act establishes a licensing and regulatory program governing offshore deepwater port development for the servicing of Very Large Crude Carriers. The Act further provides that the licensee and operator of a vessel shall be liable for $50,000,000 and $20,000,000 in damages, respectively, in the event of an oil spill.

[from Selected Water Resources Abstracts 9(10): #W76-04644. 1976]

C-2263-76
OIL AND HAZARDOUS SUBSTANCE LIABILITY
U.S. Coast Guard. 1975.
39 Federal Register #41989-94. 6p.

Regulations, Liability, Oil discharges, *Hazardous substances

The Coast Guard has proposed revisions to regulations under Section II of the Federal Water Pollution Control Act relating to the discharge and reporting of hazardous substance into navigable waters. The proposal treats hazardous substances in a manner similar to oil; thus regulations governing notification, removal, equipment requirements and discharge penalties with respect to oil would also be applied to hazardous substances.

[from Selected Water Resources Abstracts 9(10): #W76-04452. 1976]

C-2264-76
UNITED STATES ENVIRONMENTAL LAWS AND EXPLORATION AND PRODUCTION OPERATIONS
White, H.R. 1975.
Alberta Law Review 13(1):1-17.

Legislation, U.S., Production, Exploration, Oil industry, Environmental protection

A brief overview of the evolution of environmental legislation regulating the oil and gas industry is presented. The acts and regulations which must be complied with to obtain an exploration permit are described; and special attention is given to provisions in the National Environmental Policy Act, Federal Water Pollution Control Act, and the National Pollutant Discharge Elimination System which regulate the oil and gas industry.

[from Selected Water Resources Abstracts 9(8): #W76-03592. 1976]

C-2265-76
WATER POLLUTION CONTROL, MID-COURSE CORRECTION
Wiley, M.A. 1976.
Chemtech 6(2):134-141.

Wastewater treatment, Legislation, Oil industry

The petroleum industry's experiences in choosing the most cost-effective methods to meet the requirements of PL92-500 are discussed. Conclusions and recommendations regarding this water pollution control legislation are given. The industry states that the Act should be corrected now in mid-course, rather than be replaced with other untried regulatory concepts.

[from Selected Water Resources Abstracts 9(14): #W76-06978. 1976]

3. INTERNATIONAL LEGISLATION

C-2266-76
RESPONSIBILITY FOR OIL POLLUTION. INTERNATIONAL LEGISLATION
Wonham, J. 1976.
Pollution Monitor No. 29. p. 21-22.

Pollution prevention, Ships, Tankers, International conventions, Legislation, *IMCO

The contributions of the Intergovernmental Maritime Consultative Organization (IMCO) toward regulating oil pollution from shipping and establishing the rights of private parties or states threatened or damaged by pollution are assessed. Several international conventions and three major international committees are underwriting IMCO's work on marine pollution prevention and control.

[from WRC Information 3(17): # 76-1281S. 1976]

C-2267-76
AN INTEGRATED INTERNATIONAL AND DOMESTIC APPROACH TO CIVIL LIABILITY FOR VESSEL-SOURCE OIL POLLUTION
Wood, L.D. 1975.
Journal of Maritime Law and Commerce 7(1):1-68.

Liability, Oil transport, Ships, International Conventions, *Vessel-source pollution

"The various legal mechanisms which control civil liability for vessel source oil pollution are reviewed, selected features and advantages of proposed international and U.S. domestic systems to govern oil pollution liability for oil transport ships are described, and certain legal problems presented by the proposed international and national regimes for oil pollution liability are analyzed."

[from Oceanic Abstracts 13(3): #76-02970. 1976]

C-2268-76
OIL POLLUTION REGULATIONS
U.S. Coast Guard. 1974.
Federal Register 39(163):30125-30126.

Regulations, Tankers, Oil transport, International Conventions

The Coast Guard is adding an interpretive rule to pollution regulations regarding the construction of certain seagoing tankers and barges which transport oil. The rule provides coefficients for the calculation of cargo tank lengths to assure equitable treatment for barges under international law and treaties. The rule would change Annex C of the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, by allowing tank barges to be constructed with the same bulkhead spacing as tankships of comparable cargo capacity.

[from Selected Water Resources Abstracts 9(10): #W76-04851. 1976]

4. FOREIGN LEGISLATION

C-2269-76
NORTH NORWEGIAN CONTINENTAL SHELF DRILLING DELAYED (NEWS BRIEF)
Anon. 1976.
Sea Technology 17(7):38.

Offshore drilling, Biological effects, North Sea, Norway, Pollution prevention

The Norwegian Government has delayed drilling for oil on the North Norwegian continental shelf for one year to allow a massive build-up of safeguards against possible pollution before offshore activities start. The public concerned about the adequacy of anti-pollution measures, as well as environmental and fishing interests, were the main proponents of this action.

C-2270-76
LAW AND ENVIRONMENT IN THE NIGERIAN OIL INDUSTRY
Nwogugu, E.I. 1975.
Earth Law Journal 1(2):91-105.

Regulations, Oil industry, Environmental protection, *Nigeria

The legal regulations for the protection of the Nigerian environment from oil pollution and those applicable to the oil industry are discussed. The two branches of law operative in this area, statutory rules and principles of common law, are examined and their adequacy is assessed.

[from Environmental Health and Pollution Control 9(3):#845. 1976]

C-2271-76
BRAZILIAN LEGISLATION ON POLLUTION OF THE SEA AND INLAND WATERS
Saraiva, C.O. 1975.
Journal of Maritime Law and Commerce 6(3):435-439.

Legislation, Brazil, Oil discharges, *Penalties

"A full explanation of law 5.357 of Nov. 17, 1967 is given. The law sets the penalties to be imposed on ships and marine or river terminals for discharging detritus or oil in Brazilian waters and establishes other measures."

[from Oceanic Abstracts 13(3): #76-02987. 1976]

C-2272-76
FEDERAL LEGISLATION AND COMMON LAW ASPECTS OF ENVIRONMENTAL PROBLEMS IN CANADA
Stroppa, B.L. 1975.
Alberta Law Review 13(1):18-40.

Legislation, Oil industry, Environmental protection, Canada

The Canadian petroleum industry is subject to considerable statutory regulation to prevent potential adverse environmental effects. Several major legislative acts are reviewed which include: the Canada Shipping Act, the Arctic Water Pollution Control Act, the Canada Water Act, the Fisheries Act, and the Navigable Waters Act.

[from Selected Water Resources Abstracts 9(1): #W76-05231. 1976]

5. AGREEMENTS AND CONVENTIONS

C-2273-76
PROGRESS AT THE GENEVA SESSION OF THE LAW OF THE SEA CONFERENCE
Anderson, D.H. 1975.
Environmental Policy and Law 1:114-120.

International conventions, Pollution prevention, Oil transport, Tankers, Ships, Offshore development

The article briefly reviews the progress of the three main committees responsible for environmental policies at the Third UN Conference on the Law of the Sea, held in Geneva in 1975. Among the matters considered are questions of pollution during ship passage and oil transport in international and territorial waters, and new policies and regulations regarding marine pollution from land based as well as offshore installations.

C-2274-76
CONFERENCE OF PLENIPOTENTIARIES OF THE COASTAL STATES OF THE MEDITERRANEAN REGION ON THE PROTECTION OF THE MEDITERRANEAN SEA, BARCELONA, SPAIN, 2-16 FEBRUARY, 1976
Anon. 1976.
Environmental Conservation 3(2):152.

International conventions, Mediterranean Sea, Regulations, Oil discharges, Ships

On 13 February, 1976, the Conference adopted the Convention for the Protection of the Mediterranean Sea against Pollution, a Protocol for the Prevention of Pollution of Mediterranean Sea by Dumping from Ships and Aircraft, a Protocol concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency, and 10 additional resolutions.

C-2275-76
EEC AGREEMENT ON POLLUTION PROPOSALS
Anon. 1976.
Environmental Health 84(2):33.

International agreements, Oil discharges, Wastewater disposal, Europe

"Member states will be able to choose between quality objectives or emission standards for each substance on the "black list" (given in text) which may be discharged as effluents to receiving waters."

[from Industrial Wastes Information Bulletin 6(6): #HMS 6338. 1976]

C-2276-76
INTERVENTION ON THE HIGH SEAS ACT, P.L. 93-248 -- LEGISLATIVE HISTORY
Anon. 1974.
U.S. Code. Congressional and Administrative News. p. 2773-2778.

International conventions, Pollution prevention, Oil spills, Legislation, U.S.

"The International Convention Relating to Intervention on the High Seas in cases of oil pollution casualties was signed by representatives of the U.S. government. This Convention permits a coastal nation to take whatever action it deems necessary to prevent, mitigate, or eliminate a threat of pollution resulting from a maritime accident beyond that coastal nation's territorial limits."

[from Selected Water Resources Abstracts 9(10): #W76-04647. 1976]

C-2277-76
MARINE POLLUTION: NORTH-EAST ATLANTIC
Anon. 1975.
Bulletin of Legal Developments (18):191. Summary.

International conventions, Liability, Oil spills, Atlantic Ocean, Europe

A conference was scheduled for October 20-31, 1975, in London to consider a draft convention on liability for oil pollution damage resulting from seabed drilling activities. The convention was to be attended by Belgium, Denmark, France, the Federal Republic of Germany, Ireland, Netherlands, Norway, Sweden, and the United Kingdom.

[from Oceanic Abstracts 13(3): #76-02941. 1976]

C-2278-76
MEDITERRANEAN POLLUTION
Anon. 1976.
Marine Pollution Bulletin 7(6):99-100.

International conventions, Mediterranean Sea, Pollution prevention, Cleanup

The main objectives and results of the recently held Convention for the Protection of the Mediterranean Sea against Pollution, Barcelona, Spain, 1976, are discussed. Twelve of the fifteen Mediterranean coastal countries signed the Convention and Dumping Protocol. A draft protocol on cooperation in combatting oil pollution in the Mediterranean Sea was adopted, and the establishment of a regional oil combatting center was agreed upon by the signatory countries.

C-2279-6
MARINE POLLUTION
Campbell, D.,III. 1976.
Major Issues of the Law of the Sea. Durham, University of New Hampshire, 1976. Chapter VIII. p. 107-124.

International conventions, Pollution prevention, Law enforcement

Several unresolved problems and issues relating to international control of inland and marine pollution by oil and other substances are pointed out; and relevant international conventions are evaluated. For example, effective marine antipollution enforcement is limited exclusively to flag state jurisdiction. Also, land based pollution, which is believed to account for 50-90% of marine pollution, is still inadequately regulated.

[from Selected Water Resources Abstracts 9(15): #W76-07836. 1976]

C-2280-76
COMMENTARY ON: ALTERNATE APPROACHES TO ORDER: INTERNATIONAL OCEAN ORGANIZATIONS AND THEIR REGULATORY FUNCTIONS
Stein, R. 1975.
Perspectives on Ocean Policy. National Science Foundation, 1975. p. 308-311.

International conventions, Environmental protection, *Oil pollution, *Law of the Sea

Environmental issues have been pushed into the background at recent Law of the Sea Conferences, including the issue of oil pollution by ocean vessels. Unless specific treaty proposals are formulated on oil pollution and other environmental topics, little success on environmental issues can be expected from future Law of the Sea Conferences.

[from Selected Water Resources Abstracts 9(14): #W76-07343. 1976]

C-2281-76
IMCO SYMPOSIUM ON PREVENTION OF MARINE POLLUTION FROM SHIPS
Wardley-Smith, J. 1976.
Marine Pollution Bulletin 7(7):132-134.

International conventions, Pollution prevention, Oil spills, Oil transport, Ships

The proceedings of the Intergovernmental Maritime Consultative Organization (IMCO) meeting held at Acapulco, Mexico, 21-31 March 1976, is reviewed. The purpose of this technical symposium was to provide a forum in which to discuss the various scientific, technical and economic implications of the 1973 International Convention for the Prevention of Pollution from Ships.

C-2282-76
EMERGING OCEAN OIL AND MINING LAW
Warfel, S.W. 1974.
North Carolina State University Sea Grant
Report, COM-74-11014. 61 p.

International conventions, State governments, Pollution prevention, Tankers, Oil spills

Various international aspects of offshore oil operations are examined including the multinational control of oil spills, tanker discharges, and offshore drilling. State efforts to curb marine pollution, such as the North Carolina Oil Pollution Control Law, are also assessed.

[from Selected Water Resources Abstracts 9(11): #W76-05207. 1976]

C-2283-76
A PROGRESS REPORT ON THE INTERNATIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE AND ITS SUPPLEMENTARY FUND CONVENTION
Wood, L.D. 1975.
Environmental Law Reporter 5(6):50103-50107.

International conventions, Liability, Oil spills, Cleanup

The Civil Liability Convention, which has been ratified by the required number of nations to activate the treaty, provides strict liability for oil spills. The Fund Convention, which is expected to be forthcoming, is designed to establish a large cleanup compensation fund financed by a levy on oil imported by sea to contracting nations.

[from Selected Water Resources Abstracts 9(8): #W76-03584. 1976]

C-2284-76
LONG TERM PROGRAMME IN ENVIRONMENTAL POLLUTION CONTROL IN EUROPE. ECOLOGICAL ASPECTS OF POLLUTION IN THE RHINE
World Health Organization/Copenhagen, Regional Office, Europe.
1975.
ICP/CEP 207. 39 p.

International agreements, Water quality, Pollution prevention, Ecosystems, Rhine River

An international program was proposed by a WHO working group, in collaboration with the government of the Netherlands, to achieve a high standard of water quality in the Rhine. Details are presented on the scope of the study area, the basic inventories of ecosystem statics and dynamics, applied studies, and investigations of individual pollutants and indicator organisms.

6. STANDARDS AND GUIDELINES

C-2285-76
INTERNATIONAL OIL TANKERS AND TERMINAL SAFETY GUIDE
International Oil Tanker Terminal Safety Group. 1975.
New York, Wiley, 1975. 185 p. Ed. 2.

Guidelines, Oil transport, Tankers

"Mainly covers safe practices in operational aspects of handling crude oil and petroleum products at a terminal and on a tanker at a terminal."

[from Tech. Book Review Index 42(2):74. 1976]

C-2286-76
AGENCY AND INDUSTRY PRESENTATIONS
Monastero, F.C., et al. 1974.
USBLM Conference on Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast, College Park, Maryland, 1974. 90 p.

Environmental protection, Offshore development, Government agencies, Regulations

State and Federal governmental agency regulatory programs relating to offshore oil development in the Baltimore Canyon trough are described. The offshore operations, regulations, and environmental protection measures of the Exxon Corporation are presented.

[from Environment Abstracts 6(5): #76-03547. 1976]

G. BIBLIOGRAPHIES

C-2287-76
MARINE OIL SPILLS. A SELECTED BIBLIOGRAPHY
Hurley, D.E. 1975.
New Zealand Oceanographic Institute, Miscellaneous Publications 69, 1975. 68 p.

Oil spills, Biological effects, Cleanup, Absorption

This book contains 180 references on oil spills and related topics which are grouped under 16 different headings. An author index and an index to Spills, Cleansing Agents, and Absorbents are included.

[from Aquatic Sciences and Fisheries Abstracts 6(4): #6Q4262. 1976]

C-2288-76
OIL ANALYSIS BIBLIOGRAPHY
Industrial Environmental Research Lab. - CIN, Edison, New Jersey. n.d.

Chemical analysis, Source identification, Oil slicks, *Petroleum oils

"A bibliography of major methods and publications dealing with the identification and quantification of petroleum oils in water, sediments, and tissues, and oils found as shoreline residues and surface slicks, has been compiled and is available on request."

[from Aquatic Microbiology Newsletter 15(2):9. 1976]

C-2289-76
WATER POLLUTION. EFFECTS OF POLLUTION ON FRESHWATER FISH
McKim, J.M., R.L. Anderson, D.A. Benoit, R.L. Spehar, and G.N. Stokes. 1976.
Water Pollution Control Federation Journal 48(6):1544-1620.

Environmental effects, Toxicity, Freshwater, Fishes

This literature review and extensive bibliography includes sections on methodology, water quality, pesticide pollutants, industrial and domestic pollutants, and chlorinated, radioactive and other pollutants. Acute and chronic toxicities of these polluting substances, including oil, are summarized.

C-2290-76
CHRONIC OIL CONTAMINATION AND AQUATIC ORGANISMS WITH EMPHASIS ON DIPTERA: STATUS AND BIBLIOGRAPHY
Parker, B.L., J.O. Brammer, M.E. Whalon, and W.O. Berry, 1976.
Water Resources Bulletin 12(2):291-305.

Biological effects, Contamination, Freshwater, Marine organisms, *Diptera

The biological effects of continuous, low-level contamination of surface water biota by petroleum products has only recently received attention. This report presents an overview of the topic, considering both freshwater and marine organisms, and it includes an extensive bibliography as a guide to future research.

[from WRC Information 3(29): #76-2083M. 1976]

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information and a summary of project objectives are provided in each entry. Project notices have been obtained from the Smithsonian Science Information Exchange (SSIE); American Society for Microbiology, Aquatic Microbiology Newsletter; and Canada, Department of the Environment, Spill Technology Newsletter. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered by serial number within each subject division. The serial number designates the original issue of OIL SPILL AND OIL POLLUTION REPORTS in which the research project is listed:

R-001-74 to R-165-74	EPA-670/2-75-003 July to October 74
R-245-74 to R-268-74	EPA-670/2-75-059 February 75 to April 75
R-269-75 to R-304-75	EPA-600/2-76-113 August 75 to October 75
R-001-76 to R-035-76	EPA-600/2-76-185 November 75 to January 76
R-064-76 to R-123-76	May 76 to July 76
R-124-76 to R-175-76	August 76 to October 76

A. OIL POLLUTION DETECTION AND EVALUATION

1. MONITORING

R-124-76
LIGHT HYDROCARBONS-OCS

Principal Investigator:	Cline, J.D.
Performing Organization:	U.S. Department of Commerce, Environmental Research Labs, Boulder, CO 80302
Supporting Agency:	U.S. Department of Interior, Bureau of Land Management, No. R7120841
Period:	1/76 to 6/76
Funds:	$47,600

The temporal and spatial variations of the lower molecular weight hydrocarbons in the Bering Sea (Bristol Bay) and the northeast Gulf of Alaska will be determined in this research effort. Three cruises in these waters have been planned for the current year; and work will continue with data processing, reduction and report preparation on current findings.

[SSIE No. GUK-65]

R-125-76
BAY OF FUNDY STUDIES

Principal Investigator: C. Duerden
Performing Organization: Environmental Protection Service, Atlantic Region, Halifax, Nova Scotia B3J 3E4 Canada
Supporting Agency: Canada, Department of the Environment, Environmental Protection Service
Period: Unknown

The Environmental Protection Service-Atlantic Region conducted a four-day survey of the Bay of Fundy shoreline in order to identify highly sensitive areas. The development of an environmental atlas for the Bay of Fundy is nearing completion. The project should be completed by December, 1976.

Sea trials of slick-tracking devices are being prepared for the fall, 1976, at Fundy. The high frequency of fog in the bay lends particular importance to the finding of such a device that will perform properly.

[J.R. MacDonald, Environmental Protection Service-Atlantic Region. Spill Technology Newsletter 1(4):41. July-August, 1976]

R-126-76
PHYTOPLANKTON-CS

Principal Investigator: Larrance, J.D.
Performing Organization: U.S. Department of Commerce, Environmental Research Labs., Boulder, CO 80302
Supporting Agency: U.S. Department of the Interior, Bureau of Land Management, No. R7120844
Period: 1/76 to 6/76
Funds: $75,400

The research contract provides for the determination of temporal and spatial distributions of phytoplankton populations and primary productivity in the Northern Gulf of Alaska. This study is in support of an environmental impact assessment of oil and gas development. Data from samples taken will be submitted and reports written on species composition, standing stock, productivity, and related variables.

[SSIE No. GUK-70]

R-127-76
Title unknown
Principal Investigator: Wong, C.S.
Performing Organization: Department of the Environment, Ocean and Aquatic Sciences, Pacific Region, Ocean Chemistry Division, 211 Harbour Rd., Victoria, B.C., V9A 3S2 Canada
Supporting Agency: Unknown
Period: Unknown

Current research: CO_2 cycle, trace methods and marine hydrocarbons; Beaufort Sea baseline studies.

[American Society for Microbiology, Aquatic Microbiology Newsletter 15(1):45. 1976]

Reports and Publications

THE ALERT BAY OIL SPILL: A ONE-YEAR STUDY OF THE RECOVERY OF A CONTAMINATED BAY
Wong, C.S. 1974.
Pacific Marine Science Report 74-9.

Summary not available.

BASELINE INFORMATION ON CHEMICAL OCEANOGRAPHY AND PETROLEUM-BASED HYDROCARBONS IN THE SOUTHERN BEAUFORT SEA
Wong, C.S., W.J. Cretney, R.W. MacDonald, and P. Erickson. 1974.
Interim report of Beaufort Sea Project Study C3. 51p.

Chemical oceanographic studies conducted in the Beaufort Sea drilling area during summer, 1976, indicate that the marine environment in these waters is very clean. No tar or plastic wastes were found in the samples. The levels of dissolved polyaromatic hydrocarbons and gaseous hydrocarbons were found to be low, approaching those of uncontaminated Pacific Ocean waters.

DISTRIBUTION OF TAR AND OTHER PARTICULATE POLLUTANTS ALONG THE BEAUFORT SEA COAST (unpublished manuscript)
Wong, C.S., D. MacDonald, and R.D. Bellegay. 1974.
Interim Report of Beaufort Sea Project Study C1. 69p.

Baseline studies of the distribution of tar and plastic wastes, areas of natural seepage, and the characterization of hydrocarbons in sediment and marine organisms along the Beaufort Sea coast revealed the following results: no tar pollution or natural seepage was evident; and plastic wastes, particularly those related to marine seismic activities, were prevalent. Analytical work involving the characterization of hydrocarbons is still in progress.

TAR AND PARTICULATE POLLUTANTS ON THE BEAUFORT SEA COAST

Wong, C.S., D. MacDonald, and W.J. Cretney. 1976.
Beaufort Sea Project, Technical report no. 13. 96p.

The report describes the methods and results of a study designed to establish the baseline distribution of particulate pollutants, especially for tar and plastics, in the present-day Beaufort Sea marine environment; to establish areas with natural seepage of crude oil; and to determine the chemical characteristics of hydrocarbons in beach sediment, nearshore sediment, and marine organisms. Results indicated that the coastline along the Beaufort Sea studied in the summers of 1974 and 1975 is very clean with respect to oil and tar accumulation; however, plastics contamination of beach areas was prevalent. No natural seepage of crude oil was found in areas surveyed.

Information Source: C.S. Wong, Canada, Department of the Environment, Ocean and Aquatic Sciences, Pacific Region, 211 Harbour Rd., Victoria, B.C.
V9A 3S2 Canada

2. REMOTE SENSING

R-013-74 (renewal)

ANALYSIS OF DATA FROM THE EARTH RESOURCES AND TECHNOLOGY SATELLITE

Principal Investigator: Unknown
Performing Organization: University of Michigan, Graduate School, Rackham Building, Ann Arbor, MI 48104
Supporting Agency: U.S. Department of Transportation, Coast Guard
Period: 7/75 to 6/76

The usefulness of space acquired remote sensor data as an aid to the Coast Guard in the area of oil pollution detection, monitoring, and law enforcement will be investigated.

[SSIE No. GZF-30-Z]

R-128-76

DEVELOPMENT OF AN ACTIVE SPILL DETECTION SYSTEM (ASDS) FOR REMOTE DETECTION OF OIL SPILLS

Principal Investigator: Unknown
Performing Organization: Texas A and M University System, Graduate School, College Station, TX 77843
Supporting Agency: U.S. Department of Transportation, Coast Guard
Period: 7/75 to 6/76
Funds: Unknown

"Redesign the present lidar signal-processing system for use with a single-wavelength sensor. Fabricate an electronic signal-processing subsystem. Design and develop a scan capability into the monochromatic lidar sensor. Design and develop the microprocessor hardware. Revise the software algorithm for single-wavelength, hardened microprocessor. Perform laboratory and field tests of the ASDS system.

[SSIE No. GZ-58525]

3. ANALYSIS

R-129-76

IN SITU POLLUTANT MEASUREMENTS

Principal Investigators: Perkins, R.W., and N.A. Wogman
Performing Organization: Battelle Memorial Institute, P.O. Box 999, Richland, WA 99352
Supporting Agency: U.S. Energy Research and Development Administration, Biomedical and Environmental Research Division, Contract E(45-1)-1830
Period: 7/75 to 6/76

The study aim is to determine the feasibility of sensitive, instrumental, analytical techniques for in situ analyses of pollutants including Hg, As, Pb, Se, Cd, neutral radioisotopes, and a variety of fission and activation products. Crude oil fractions and petroleum products which can accumulate in the sediments will also be studied.

[SSIE No. ZPE-11589]

R-130-76

STUDY ON NATURAL HYDROCARBON SEEPAGE IN THE MARINE ENVIRONMENT

Principal Investigators: Sweet, W.A., and R.A. Geyer
Performing Organization: Texas A and M University System, School of Geosciences, College Station, TX 77843
Supporting Agency: Cities Service Oil Company
Period: 7/74 to 6/75

The study will locate and study hydrocarbon seeps in the marine environment, particularly the Gulf of Mexico. Chemical analyses are being made of tars collected from Texas beaches to determine their characteristics and possible sources. Chemical characteristics of naturally weathered oil and biological effects in seepage areas are also being studied. This project has demonstrated that Gulf producing wells are not sources of tar on Texas beaches.

Reports and Publications

MARINE ACOUSTICAL SEEP DETECTION
Sweet, W.E. 1974.
AAPG Bulletin 5(6):1133-1136.

Summary not available.

TAR BALLS IN THE SEA: A NEW SOURCE CONCEPT
Sweet, W.E. 1974.
Offshore Technology Conference, 6th, Houston, 1974. OTC No. 2002.

Summary not available.

[SSIE No. BI-450-1]

R-131-76
AUTOMATIC POLLUTION DETECTION

Principal Investigator:	Unknown
Performing Organization:	French Institute of Petroleum, 1-4 Ave. de Boispreau, Rueil Malmaison France 92502
Supporting Agency:	France. French Institute of Petroleum
Period:	7/75 to 6/76

The project objectives are to determine the thickness of a layer of hydrocarbons on the ocean by using extremely-high frequency and super-high frequency waves, and to eliminate the ambiguity of hydrocarbon detection by using UV lasers to excite the fluorescence of oil.

[SSIE No. BT-959]

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

R-132-76
DEMONSTRATION OF A LARGE SCALE INNOVATIVE OIL SPILL CONTROL SYSTEM UTILIZING ELECTRIC FIELDS
Principal Investigator: Unknown
Performing Organization: TechnomareEnterprises, Los Angeles, CA 90024
Supporting Agency: U.S. Department of Transportation, Coast Guard, No. 058412
Period: 7/75 to 6/76
Funds: Multiple support

Objectives include: demonstration of the control and containment of oil spills in fresh water by the utilization of electric fields; control and containment of oil spills up to about 1 ton at relative velocities of up to 11 km/hr; and control of the movement and spreading of the floating oil having a thickness up to about 5 cm.

[SSIE No. GZ-58412]

R-133-76
RESEARCH, DESIGN, AND DEVELOPMENT OF THE HIGH SEAS OIL CONTAINMENT SYSTEM
Principal Investigator: Unknown
Performing Organization: Battelle Memorial Institute, 505 King Ave., Columbus, OH 43201
Supporting Agency: U.S. Department of Transportation, Coast Guard, No. 058423
Period: 7/75 to 6/76

No summary provided to SSIE.

[SSIE No. GZ-58423]

R-075-76

CONDUCT TEST IN AN OIL/ICE/WATER CONTROLLED ENVIRONMENT TEST FACILITY ON OIL RECOVERY DEVICES

Principal Investigator:	Unknown
Performing Organization:	Arctec Inc., Suite 225, Wilde Lake Village Green, Columbia, MD 21045
Supporting Agency:	U.S. Department of Transportation, Coast Guard
Period:	1/75 to 6/75 (est.)

The performing agency will 1) prepare for testing the facilities and devices for Phase 1; 2) assemble and checkout the instrumentation required to obtain data on oil/water recovery rate, oil recovery rate, recovery efficiency, throughput efficiency, oil characteristics, characteristics of recovered mixture and ice thickness, percent coverage, and volume of oil absorbed into ice; 3) prepare a detailed test plan; and 4) conduct tests.

[MRIS Abstracts 12:#058308. 1975]

Reports and Publications

TESTS OF OIL RECOVERY DEVICES IN A BROKEN ICE FIELD
Getman, J.H., L.A. Schultz. 1976.
Offshore Technology Conference, 8th, Houston, 1976.
Paper no. OTC-2695. p.901-916.

The U.S. Coast Guard is conducting tests on several oil spill recovery devices which may be effective for recovery in ice-infested waters. The paper describes the test program and results. Both Lockheed and Marco spill recovery units successfully recovered oil under simulated conditions but proved unreliable in cold environment field tests. Necessary modifications for improved performance have been identified and have been implemented for further tests.

TESTS OF OIL RECOVERY DEVICES IN ICE COVERED WATERS
Getman, J.H., L.A. Schultz, and P.C. Deslauriers. 1975.
International Conference on Port and Ocean Engineering Under Arctic Conditions, 3rd, University of Alaska, 1975.

The U.S. Coast Guard conducted tests on two oil spill recovery devices operating in a simulated arctic environment to determine the oil recovery capability of the two devices in broken freshwater ice and broken saltwater ice using No. 2 diesel oil and crude oil. These tests demonstrated that with minor hardware modifications and proper operating procedures, both devices will successfully recover crude oil and No. 2 diesel oil spilled in a broken ice field of moderate ice piece size.

TESTS OF OIL RECOVERY DEVICES IN BROKEN ICE FIELDS. PHASE I.
Schultz, L.A., P.C. Deslauriers, R.P. Voelker, O.M. Halstad, and D.E. Abrams. 1975
Final report, No. 228-C, USCG-D-130-75; Contract DOT-CG-51487-A. 91p.

Full size tests of the Lockheed Clean Sweep Model R 2003 and the Marco Pollution Control Class 1 Oil Recovery System are reported. Tests using No. 2 diesel oil and crude oil were done in a simulated Arctic environment in broken fresh water ice and salt water ice. Only minor hardware modifications are needed in order for both models to recover spilled oil in an ice field of moderate ice piece size.

TESTS OF OIL RECOVERY DEVICES IN BROKEN ICE FIELDS. PHASE II.
Schultz, L.A. 1976.
Final report, No. 273-C, USCG-D-55-76; Contract DOT-CG-51487-A. 179p.

Summarized are results of tests which measured the effectiveness of five oil spill recovery devices in removing crude oil and No. 2 fuel oil in broken ice cover. The recovery devices were manufactured by Lockheed, Marco, Ocean Systems, JBF Scientific, and Oil Mop. The natural spill thickness of crude oil and No. 2 fuel oil in open water and in broken ice cover was investigated.

Information Source: L.A. Schultz, Arctec, Inc., 9104 Red Branch Rd., Columbia, MD 21045

R-134-76
SHAKEDOWN AND DEMONSTRATION OF PROTOTYPE HAZARDOUS MATERIAL SPILL CONTROL DEVICES
Principal Investigator: Sproul, M.L.
Performing Organization: Mason & Hanger Silas Mason Co., P.O. Box 1316, Edison, NJ 08817
Supporting Agency: U.S. Environmental Protection Agency, National Environmental Research Center
Period: 7/74 to 6/75
Funds: $50,000

The project pertains to the establishment and operation of an Environmental Emergency Response Unit (EERU) at the EPA facilities in Edison, New Jersey. The unit will provide for the operation of oil and hazardous material spill control prototype devices during spill situations; the repair, modification, and demonstration of these devices; and the establishment and operation of a set of pilot plants to be used for the determination of the best practicable application of the prototype equipment and other equipment and techniques for oil and hazardous materials.

[SSIE No. GMA-2372]

R-135-76
Title unknown

Principal Investigator:	Unknown
Performing Organization:	Canada, Department of the Environment, Environmental Emergency Branch, Ottawa, Ontario K1A 0H3
Supporting Agency:	Canada, Department of the Environment
Period:	Unknown (continuing)

A study is underway to investigate innovative approaches to deal with oil blow-outs using underwater ignition techniques, containment methods, channelling devices, etc., as a means by which oil does not reach the water, ice, or ice/water surfaces.

[W.J. Logan, Environmental Protection Service, Environmental Emergency Branch. Spill Technology Newsletter 1(4):17. July-August, 1976]

R-136-75
CURRENT DISPERSANT ACTIVITIES IN THE ENVIRONMENTAL EMERGENCY BRANCH

Principal Investigator:	Unknown
Performing Organization:	Canada, Department of the Environment, Environmental Emergency Branch, Ottawa, Ontario K1A 0H3
Supporting Agency:	Canada, Department of the Environment
Period:	Unknown (continuing)

The Environmental Emergency branch has initiated several projects concerning oil dispersants. Studies on the following topics are being conducted: (1) effectiveness testing and toxicity of dispersants (Halifax); (2) uptake of labelled chemically and physically dispersed oil by fish at below lethal levels, and tests of the avoidance reaction by fish to dispersed oil (P. Belton and B. McKeown, Simon Fraser Univeristy); (3) effect of oil on aquatic organisms (Arctic Biological Station, St. Anne de Bellevue; Bedford Institute of Oceanography); (4) feasibility of and logistic support needed for the aerial application of dispersants in the Beaufort Sea (Dames and Moore); (5) field effectiveness of dispersants in cold water (Canadian Coast Guard); (6) dispersant application techniques (to be studied by a recently established task force of oil industry and government representatives); and (7) the 3-dimensional modelling of the short term fate of chemically and physically dispersed oil. In addition to the testing work a comprehensive bibliography on dispersants is being prepared in Halifax and will be published in the new year.

Reports and Publications

EFFECTS OF CRUDE OILS ON ARCTIC MARINE INVERTEBRATES
Author and date unknown.
Beaufort Sea Technical Report No. 11.

THE EFFECTIVENESS AND TOXICITY OF THE OIL DISPERSANT-OILSPERSE 43-IN LARGE OUTDOOR TANKS
Author and date unknown.
EPS Surveillance Report EPS5-AR-75-8.

Information Source: C.W. Ross, Environmental Protection Service, Environmental Emergency Branch. Spill Technology Newsletter 1(4):38-39. July-August, 1976]

R-137-76
IGNITING SPILLED OIL ON ARCTIC ICE

Principal Investigator:	Unknown
Performing Organization:	Canada, Department of the Environment, Environmental Emergency Branch, Ottawa, Ontario K1A OH3
Supporting Agency:	Canada, Department of the Environment
Period:	Unknown (continuing)

A project is being undertaken to evaluate the optimum use of combustion promoters and to study the logistics of burning the thousands of oiled pools on ice in the spring following a blowout.

[W.J. Logan, Environmental Protection Service, Environmental Emergency Branch. Spill Technology Newsletter 1(4):17. July-August, 1976]

R-138-76
PERFORMANCE OF A WEIR SKIMMER DEVICE INCORPORATED INTO THE STRUTS OF A COAST GUARD HIGH-SEAS OIL CONTAINMENT BARRIER

Principal Investigator:	Unknown
Performing Organization:	Offshore Devices Inc., Lynn, MA 01902
Supporting Agency:	U.S. Department of Transportation, Coast Guard
Period:	7/75 to 6/76

Tasks include design, fabrication, and testing of the skimmer struts; design, construction, and testing of the pumping system; and testing of the skimming barrier design at the OHMSETT facility.

[SSIE No. GZ-58528]

Status: The project is still in progress, and no further reports have been completed.

Information Source: E. Chance Swett, Offshore Devices, Inc.,
106 Sanderson St., Lynn, MA 01902

3. RESTORATION

R-139-76
BIONOMICS AND ECOLOGY OF THE JACKASS PENGUIN (SPHENICUS DEMERSUS) WITH REFERENCE TO CONSERVATION OF THE SPECIES

Principal Investigator:	Siegfried, W.R.
Performing Organization:	University of Cape Town, Fitzpatrick Institute, Rondebosch 7700, C.P. 7700, Capetown, Cape of Good Hope, Republic of South America
Supporting Agency:	National Geographic Society
Period:	5/76 to 5/77
Funds:	$30,000

Thousands of jackass penguins are oiled from ships discharging oil at sea. Efforts are being made to rehabilitate them for normal growth in the wild. In this study, observers will visit certain islands at monthly intervals during 1976 and populations of rehabilitated birds and "normal" birds will be monitored. Resulting data will permit computer analyses aimed at revealing differential mortality and breeding success. Information on the movement of penguins will also be provided.

[SSIE No. BU-678]

4. OIL TRANSFER AND TRANSPORT

R-140-76
ENVIRONMENTAL ASPECTS OF A SUPERTANKER PORT OFF THE TEXAS COAST

Principal Investigator:	Unknown
Performing Organization:	Texas A and M University System, School of Engineering, P.O. Box FE 44, College Station, TX 77843
Supporting Agency:	Seadock Inc.
Period:	7/74 to 12/75

Texas A and M Research Foundation has been conducting a study to estimate adverse and beneficial effects that the proposed supertanker port off the Texas coast might have on the marine environment. Baseline studies of this area were conducted during the four seasons of the year. Physical, chemical, and biological parameters have been measured for sampling stations established along the pipeline route. Computer models were developed to estimate the probability of an accidental, uncontrolled oil spill in marine waters.

[SSIE No. BO-170]

5. WASTE TREATMENT AND DISPOSAL METHODS

R-156-74 (renewal)

FEASIBILITY STUDY FOR ULTRAFILTRATION CONCEPT FOR OIL WATER SEPARATION

Principal Investigator:	Unknown
Performing Organization:	Abcor Inc., 341 Vassar St., Cambridge, MA 02139
Supporting Agency:	U.S. Department of Transportation, Coast Guard
Period:	7/75 to 6/76

The contractors will evaluate the feasibility of unique concepts for oil water separation for ultimate use in various shipboard applications.

[SSIE No. GZF-38-2]

R-141-76

WATER MANAGEMENT STUDY

Principal Investigator:	Goldstein, P.
Performing Organization:	N.U.S. Corporation, Pittsburgh, PA 15205
Supporting Agency:	American Petroleum Institute
Period:	1/75 to 12/75

"Costs for retrofitting three refineries of high complexity with elimination of discharge of pollutants (EDOP) facilities will be developed." The resultant outlines of case history costs will provide guidelines to which individual refineries can refer when developing their own costs for the incorporation of EDOP systems.

[SSIE No. PAP-116]

R-142-76

SOUR WATER STRIPPER PROCESS DESIGN CRITERIA, CONTROL METHODS, AND PHASE EQUILIBRIA

Principal Investigators:	Porter, J.W., A.H. Hall, and G.M. Wilson
Performing Organization:	Bechtel Corporation, 50 Beale St., San Francisco, CA
Supporting Agency:	American Petroleum Institute
Period:	1/75 to 12/75

Over 300 sour water strippers could be forced to shut down due to stricter environmental controls mandated for 1977. Alternatives involve partial or complete duplication of facilities, special impounding basins, or reliable operation of the strippers. This program is jointly sponsored by the Committee on Refinery Environmental Control, Committee on Refinery Equipment, and Committee on Research, Data, and Information Services.

Reports and Publications

SOUR WATER STRIPPER OPERATIONS
Gantz, R.G. 1975.
Oil and Gas Journal

STRIPPER PERFORMANCE TIED TO NH_3 FIXATION
Gantz, R.G. 1975.
Hydrocarbon Processing

Information Source: R.T. Milligan, Bechtel Corporation, P.O. Box 3965., San Francisco, CA 94119

R-143-76

NATIONAL ECONOMIC MODELS OF INDUSTRIAL WATER USE AND WASTE TREATMENT

Principal Investigator:	Thompson, R.C.
Performing Organization:	University of Houston, School of Business Administration, 3801 Cullen Blvd., Houston, TX 77004
Supporting Agency:	U.S. National Science Foundation, Division of Advanced Environmental Research and Technology
Period:	7/74 to 8/75

This project is a continuation of an earlier project, the main objective of which was to develop production functions for the five most important water using industries (including the petroleum refining industry). The proposed project will refine, extend, and further verify the industrial models to permit evaluation of the effects of increasing scarcity of clean fuels on production costs, water use, air pollution, solid waste residuals, and brine disposal.

[SSIE No. GSQ-1497]

R-144-76
WATER RE-USE STUDY

Principal Investigator:	Unknown
Performing Organization:	N.U.S. Corporation, Rockville, MD 20850
Supporting Agency:	American Petroleum Institute, No. CREC-1
Period:	7/75 to 6/76

The feasibility and cost of achieving a refinery water re-use system that would result in a zero discharge of pollutants in accordance with the Federal Water Pollution Control Act of 1972 will be determined. Current studies comprise pilot evaluations of existing methods including various water processing schemes. Work has concentrated on the water re-use concepts for grass root refineries.

[SSIE No. PAP-126-1]

R-283-75

OIL SPILL CONTROL COURSE

Principal Instructors:	Payne, J.L., and C. Page
Performing Organization:	Texas A and M University System, Texas Engineering Extension Service, FE Drawer K, College Station, TX 77843
Supporting Agency:	American Petroleum Institute
Period:	4/75 to unknown

Texas A and M University received a contract from the American Petroleum Institute to develop an oil spill control course that would be offered to industry on a continuing basis. The Oil Spill Control Course, which is currently being offered twice a month at the University facility in Galveston, provides participants with the information and training necessary for handling an oil spill within the capabilities of available manpower and equipment.

Reports and Publications

OIL SPILLS: FIRE DEPARTMENT RESPONSE AND RESPONSIBILITY
Payne, J.L.
Fire Engineering. In press.

This paper deals primarily with oil spills on land and suggested methodology for handling such situations.

OIL SPILL: TEXAS A AND M UNIVERSITY'S EFFORTS
Payne, J.L. 1977.
To be presented at Oil Spill Conference, New Orleans, March, 1977.

The Oil Spill Control Course conducted in Galveston, Texas, by Texas A and M University's Engineering Extension Service will be described. The program's growth and development will be briefly documented. Topics of importance include: Educational Objectives, Instructional Modes, and Program Assessment. An outline of the Engineering Extension Service's proposals for updating and expanding its training program will be discussed.

Information Source: J.L. Payne, Texas A and M University System, Texas Engineering Extension Service, F.E. Drawer K, College Station, TX 77843

R-145-76

PROCEDURES FOR DISPOSAL OF OIL SPILL DEBRIS (OTHER THAN INCINERATION)

Principal Investigators:	Stearns, R.P., D.E. Ross, R.J. Lofy, and D. Weaver
Performing Organization:	SCS Engineers, 4014 Long Beach Blvd., Suite 211, Long Beach, CA 90807
Supporting Agency:	U.S. Environmental Protection Agency, National Environmental Research Center, Contract No. 68-03-2200
Period:	7/74 to 6/76
Funds:	$97,884

The project objectives are to evaluate historical and literature base data pertaining to the land disposal of oil spill debris materials, and to develop an instruction manual and training film for use in orienting local and state government officials toward the proper preparation and operation of oil spill debris disposal sites.

[SSIE No. GMA-2352]

Status: The preliminary draft of the manual and supporting technical data have been completed and are presently being reviewed by EPA personnel. The report has been prepared in two volumes:

Volume I-A procedures manual on oil spill debris disposal alternatives.

Volume II-Technical information from literature search and case study investigations at four oily waste disposal sites.

Also, SCS has prepared a training film on the subject which is being reviewed. It is anticipated that a paper covering the entire project will be presented at the 1977 Oil Spill Conference in New Orleans in March.

Reports and Publications

PRACTICAL RECOMMENDATIONS FOR OIL SPILL DEBRIS DISPOSAL: A PROGRESS REPORT
Farlow, J.S., and D.E. Ross. 1976.
Paper presented at Tucson, Arizona, February 2, 1976. 5p.

The U.S. Environmental Protection Agency has retained SCS Engineers, Inc., to prepare a detailed, practical how-to-do-it manual for oil spill debris disposal and to make an accompanying film for state and local officials. A literature search has been conducted and sites for confirming field studies chosen. Present recommendations for disposal of recyclable material include soil cultivation, incorporation into an approved sanitary landfill, and individual burial. A description of the rationale for selecting certain disposal methods and findings to date are presented.

Information Source: D.E. Ross, SCS Engineers, 4014 Long Beach
Blvd., Long Beach, CA 90807

7. PREVENTION AND CONTROL MEASURES

R-146-76
HYDRAULIC RESEARCH FOR OIL SPILL CONTROL IN FLOWING WATERS INCLUDING STUDY OF INTERFACIAL FRICTION FACTORS FOR OIL SLICKS (ABBREV.)

Principal Investigator:	Moir, J.
Performing Organization:	Unknown institute or individual grant, Canada
Supporting Agency:	Canada, Department of the Environment
Period:	7/75 to 6/76
Funds:	$2,333

No summary provided to SSIE.

[SSIE No. WDB-15]

R-147-76
HYDRAULICALLY CONTROLLED SAFETY SYSTEM USED DURING TESTING OF OIL WELLS FROM A FLOATING DRILLING RIG

Principal Investigator:	Turner, R.G.
Performing Organization:	Baker Oil Tools Inc., Houston, TX 77001
Supporting Agency:	Baker Oil Tools Inc.
Period:	7/74 to 11/74

The system is designed to contain flow out of an oil well in an ocean environment should a floating drilling vessel have to move off location during flow testing of oil and/or gas reservoir potential evaluation or due to weather conditions.

[SSIE No. BO-83]

R-148-76
PROTECTING SEA WATER

Principal Investigator:	Unknown
Performing Organization:	French Institute of Petroleum, 1-4 Ave. de Boispreau, Rueil Malmaison, France 92502
Supporting Agency:	France. French Institute of Petroleum
Period:	7/75 to 6/76

"This project will enable IFF to participate with many non-French institutions in research within the national context of France that will identify, evaluate, and reduce the pollution of the ocean and will enable us to develop petroleum activities without destroying marine ecology."

[SSIE No. BT-974]

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

R-101-74 (renewal)
MARINE PETROLEUM POLLUTION-BIOLOGICAL EFFECTS AND CHEMICAL CHARACTERIZATION
Principal Investigators: Nicol, J.A., and C. VanBaalen
Performing Organization: University of Texas, Marine Science Institution, Port Aransas, TX 78373
Supporting Agency: U.S. National Science Foundation, Division of National and International Programs, No. ID073-09740 A01
Period: 1/76 to 12/76
Funds: $111,850

Laboratory and field studies will be conducted to study the impact of petroleum on bacteria, microalgae, and marine invertebrates. An analytical study of aromatic and other petroleum hydrocarbon fractions found in the field and used for testing organisms will support the biological effects study.

[SSIE No. GSN-1146-3]

R-255-74 (renewal)
BIOLOGICAL FIELD STUDIES OF EFFECTS OF OIL ON MARINE ORGANISMS
Principal Investigators: Anderson, J.W., and J.M. Neff
Performing Organization: Texas A and M University System, Center for Marine Resources, College Station, TX 77843
Supporting Agency: American Petroleum Institute, No. 206-75
Period: Unknown (continuing)

The research applies technology and data gained in laboratory models which measure the toxicity of several oils to the natural marine environment. Oysters, clams, marine worms, shrimp, and fish are being exposed and studied for such effects as mortality, growth, inhibition and enhancement, altered physiology, carcinogenesis, and reproduction. Any such effects will be related to appropriate measurements of hydrocarbons in organisms' tissues and in the environment.

[Environmental Research, Annual Status Report, API Publication No. 4275. February, 1976]

Reports and Publications (summaries not available)

SIGNIFICANCE OF STUDIES ON SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS
Anderson, J.W. 1977.
Fate and Effects of Petroleum in Marine Ecosystems and Organisms. Proceedings of NOAA Symposium, Seattle, November 10-12, 1976. In press.

BIOAVAILABILITY OF SEDIMENT-SORBED NAPHTHALENES TO THE SIPUNCULID WORM, PHASCOLOSOMA AGASSIZII
Anderson, J.W., L.J. Moore, J.W. Blaylock, D.L. Woodruff, and S.L. Kiesser. 1977.
Fate and Effects of Petroleum in Marine Ecosystems and Organisms. Proceedings of NOAA Symposium, Seattle, November 10-12, 1976. In press.

DISTRIBUTION OF NAPHTHALENES WITHIN EXPOSED FUNDULUS SIMILUS AND CORRELATIONS WITH STRESS BEHAVIOR
Dixit, D., and J.W. Anderson. 1977.
Conference on Prevention and Control of Oil Pollution, New Orleans, 1977. In press.

ACCUMULATION AND RELEASE OF PETROLEUM-DERIVED AROMATIC HYDROCARBONS BY FOUR SPECIES OF MARINE ANIMALS
Neff, J.M., D. Dixit, B.A. Cox, and J.W. Anderson. 1976.
Marine Biology. In press.

ACCUMULATION AND RELEASE OF FUEL OIL DERIVED DIAROMATIC HYDROCARBONS BY THE POLYCHAETE, NEANTHES ARENACEODENTATA (MOORE)
Rossi, S.S., and J.W. Anderson. 1976.
Marine Biology. In press.

TOXICITY OF WATER-SOLUBLE FRACTIONS OF NO. 2 FUEL OIL AND SOUTH LOUISIANA CRUDE OIL TO SELECTED STAGES IN THE LIFE HISTORY OF THE POLYCHAETE, NEANTHES ARENACEODENTATA
Rossi, S.S., and J.W. Anderson. 1976.
Bulletin of Environmental Contamination and Toxicology 16:18-24.

Information Source: J.W. Anderson, Battelle, Pacific Northwest Division, Marine Research Laboratory, Route 5, Box 100, Sequim, WA 98382

R-105-76

LONG-TERM EFFECTS OF HYDROCARBONS ON SELECTED ECOSYSTEMS AND ASSOCIATED ORGANISMS

Principal Investigators: Gibson, C.I., J.R. Vanderhorst, and R.M. Bean
Performing Organization: Battelle Memorial Institute, P.O. Box 999, Richland, WA 99352
Supporting Agency: U.S. Energy Research and Development Administration, Biomedical and Environmental Research Division, Contract E(45-1)-1830
Period: 7/75 to 6/76

This program will examine the laboratory response of populations and benthic communities to concentrations of single hydrocarbon compounds and aqueous phase petroleum, and the in situ response of coastal communities to sediment-bound petroleum.

[SSIE No. ZPE-11367]

Results: "Emphasis during the first half of the year has been to investigate the utility of concrete construction blocks as artificial substrates for in situ colonizing and laboratory treatment of marine intertidal communities to standardize laboratory delivery of 'soluble' phase of petroleum, and to develop on-site analytical capability. Data from concrete blocks treated with Prudhoe Bay crude oil and allowed to colonize in situ indicate an apparent reduction in the numbers of species, numbers of individuals, and biomass in treated as opposed to untreated blocks. Indices of community structure computed from the data detect significant (0.05) differences in species diversity and species dominance for experimentals and controls."

Information Source: SSIE No. ZPE-11592.

R-149-76

METABOLISM OF INDIVIDUAL ALIPHATIC AND AROMATIC HYDROCARBON ISOMERS PRESENT IN CRUDE OIL IN WARM AND COLD MARINE SPECIES (ABBREV.)

Principal Investigators: Bend, J.R., and M.O. James
Performing Organization: U.S. Department of Health, Education, and Welfare, P.H.S. National Institutes of Health, Durham, NC 27709
Supporting Agency: U.S. Department of Health, Education, and Welfare
Period: Continuing

The in vitro metabolism of selected hydrocarbons of crude or refined petroleum products will be studied in marine species in Florida and compared to earlier works with marine species. Special attention will focus on the polycyclic aromatic hydrocarbons. The effects of pollutant exposure on the subsequent uptake, distribution, metabolism, and excretion of selected hydrocarbons in marine animals will also be monitored.

[SSIE No. ZXS-458]

Reports and Publications

IN VITRO METABOLISM OF XENOBIOTICS IN SOME MARINE ANIMALS
Bend, J.R., M.O. James, and P.M. Dansette. 1976.
Conference on Aquatic Pollutants and Biological Effects with Emphasis on Neoplasia, New York City, September, 1976. Annals New York Academy of Sciences. New York Academy of Sciences. In press.

"This paper describes microsomal mixed-function oxidase (MFO) activity in selected marine species native to the East Coast of North America with several substrates (benzo(a)pyrene, benzphetamine, and 7-ethoxycoumarin), the further biotransformation of alkene and arene oxides by epoxide hydrase or glutathione S-transferases, and the effect of fish pretreatment with 3-methylcholanthrene (3-MC) on MFO and epoxide-metabolizing enzyme activities in two Florida marine species."

HEPATIC MICROSOMAL AND SOLUBILIZED MIXED-FUNCTION OXIDASE SYSTEMS FROM THE LITTLE SKATE, RAJA ERINACEA, A MARINE ELASMOBRANCH
Bend, J.R., R.J. Pohl, E. Arinc, and R.M. Philpot. 1976.
Third International Symposium on Microsomes and Drug Oxidations, Berlin, 1976. Oxford, England, Pergamon Press. In press.

"The sea is a repository for numerous xenobiotics that occur as environmental contaminants. Many sources of these pollutants are known including dumping of industrial and urban wastes, atmospheric fallout of airborne substances, runoff from agricultural areas treated with herbicides or insecticides, shipping spillage (both accidental and intentional), and natural seepage of hydrocarbons from underwater oil deposits." In this paper, the effect of pretreating little skates with 3-methylcholanthrene or 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) on hepatic microsomal mixed-function oxidase (MFO) activity and/or cytochrome P-450 content is reported, as well as the solubilization, partial purification, and reconstitution of the hepatic microsomal MFO system from untreated skates.

MIXED-FUNCTION OXIDASE (MFO) ACTIVITY IN FLORIDA MARINE SPECIES

James, M.O., and J.R. Bend. 1976.
Pharmacologist 18:207.

"Many chemicals which contaminate the marine environment are metabolized in mammalian species via the MFO systems to products which are often more toxic. Cytochrome P-450 content and benzo(a)pyrene hydroxylase, 7-ethoxycoumarin O-deethylase and benzphetamine N-demethylase activities were measured in several Florida marine species." Results are presented .

METABOLISM OF BENZO(A)PYRENE AND OTHER XENOBIOTICS BY MICROSOMAL MIXED-FUNCTION OXIDASES IN MARINE SPECIES

Philpot, R.M., M.O. James, and J.R. Bend. 1976.
Sources, Effects and Sinks of Petroleum in the Aquatic Environment. American Institute of Biological Sciences Symposium, Washington, D.C., 1976. In press.

Benzo(a)pyrene and other compounds were metabolized by hepatic microsomal preparations from several species of teleosts and elasmobranchs. The oxidative metabolism of xenobiotics by marine species is catalyzed by a microsomal mixed-function oxidase system. The enzymes cytochrome P-450 and NADPH-cytochrome C reductase were shown to be required for the reconstitution of skate mixed-function oxidase activity. The absence of mixed-function oxidase activity in marine species could result in the storage of dangerous substances in species which are used as a food source by man.

XENOBIOTIC METABOLISM IN MARINE FISH TREATED WITH 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD), 3-METHYLCHOLANTHRENE (3-MC), OR 1,2,3,4-DIBENZANTHRACENE (DBA)

Pohl, R.J., M.O. James, J.R. Fouts, and J.R. Bend. 1976.
Pharmacologist 18:207.

Hepatic microsomal benzo(a)pyrene hydroxylase (AHH) activity was significantly increased (up to 20-fold) in the little skate, *Raja erinacea*, following IP administration of TCDD, DBA, or 3-MC or oral administration of 3-MC. Similar induction activity was noted in two teleosts, the winter flounder (*Pseudopleuronectes americanus*) after oral TCDD administration and in the sheepshead (*Archasargus probatocephalus*) after IP 3-MC.

Information Source: J.R. Bend, Pharmacology Branch, Department of Health, Education, and Welfare, National Institute of Environmental Health Sciences,
P.O. Box 12233, Research Triangle Park,
NC 27709

R-150-76

RECOVERY OF BENTHIC FAUNA FROM CHRONIC OIL POLLUTION (N. BALTIC)

Principal Investigator: Leppäkoski, E.J.

Performing Organization: Institute of Biology, Åbo Akademi,
SF-20500 Turku, Finland

Supporting Agency: Unknown

Period: Unknown (continuing)

Reports and Publications

ASSESSMENT OF DEGREE OF POLLUTION ON THE BASIS OF MACROZOOBENTHOS IN MARINE AND BRACKISH-WATER ENVIRONMENTS
Leppäkoski, E. 1975.
Acta Acad. Aboensis B 35(2):1-90.

Information Source: American Society for Microbiology. Aquatic Microbiology Newsletter 15(2): 1976]

R-151-76

EFFECT OF POLLUTANTS ON ECOLOGICALLY IMPORTANT POLYCHAETE SPECIES

Principal Investigator: Reish, D.J.

Performing Organization: California State University and Colleges,
School of Letters and Sciences, 6101 E.
7th St., Long Beach, CA 90840

Supporting Agency: U.S. Environmental Protection Agency,
Office of Research and Development

Period: 3/75 to 2/76

Funds: $63,300

The two main objectives of this research are: to study the effects of selected heavy metals, pesticides, and petrochemicals on larval, juvenile, and adult polychaetes through at least one complete life cycle, and to develop laboratory strains of polychaetes which can be used as test organisms for these bioassays. A manual will be presented outlining the procedures to follow for culturing and conducting bioassays for each species.

[SSIE No. GMA-2455]

R-152-76

ALASKAN OIL SEEPS-THEIR CHEMICAL AND BIOLOGICAL EFFECTS ON THE INTERTIDAL ENVIRONMENT

Principal Investigator: Shaw, P.G.

Performing Organization: University of Alaska, Graduate School,
Fairbanks, AL 99701

Supporting Agency: U.S. Environmental Protection Agency,
Office of Research and Development

Period: 6/75 to 5/76

Funds: $130,000

The effect of chronic low-level petroleum input to the intertidal environment by oil seeps will be studied. Chemical measurements of the kinds and amounts of hydrocarbons in water, sediment, and selected biota of seep and control areas will be conducted. Biological measurements of the fitness of selected species and communities in oiled and unoiled sites will focus on phytoplankton and sessile benthic infauna and epifauna. Based on the results of the first year's work, a single site and control will be selected for further study during the following two years.

[SSIE No. GNA-2443]

R-153-76
HYDROCARBON STUDY

Principal Investigator:	Unknown
Performing Organization:	U.S. Department of Commerce, National Marine Fisheries Service, Southeast Fisheries Center, 75 Virginia Beach D., Miami, FL 33149
Supporting Agency:	U.S. Environmental Protection Agency
Period:	6/76 to 5/77
Funds:	$85,000

This study is designed to determine the accumulation and elimination of a certain carcinogenic aromatic petroleum hydrocarbon by selected test marine organisms of species that are used for human consumption. Shrimp and snapper have been chosen as test organisms. Different tissues of both control and hydrocarbon exposed organisms will be analyzed at 4-day, 7-day and 14-day intervals up to 35 days. Animals exposed to 1 ppb hydrocarbons and 5 ppb hydrocarbons for 35 days will be transferred to tanks with uncontaminated seawater and tissue analyses will be made at the given day intervals.

[R. Farragut, U.S. Department of Commerce, National Marine Fisheries Service, Southeast Fisheries Center, 75 Virginia Beach Dr., Miami, FL 33149]

2. GENERAL EFFECTS

R-296-75 (renewal)
ENVIRONMENTAL SUPPORT TECHNOLOGY: INTERFACE CHEMISTRY IN THE MARINE ENVIRONMENT AND ITS EFFECT ON NAVAL OPERATIONS
Principal Investigators: Garrett, W.D., and W.R. Barger
Performing Organization: U.S. Navy Research Laboratory, Washington, D.C. 20390
Supporting Agency: U.S. Department of Defense, Navy
Period: 7/75 to 6/76

Objectives of the project are: to enhance naval operations by chemical modification of the air-sea interface, to evaluate the role of natural, artificial and pollutant suface films on air-sea interactions, and to determine the influence of organic films on atmospheric processes. Based on laboratory, test tank, and field experiments, surface-active chemicals have been selected for use as sea markers to control oil pollution at naval ship installations.

[SSIE No. ZQN-20190-2]

R-154-76
OIL SPILLS-EFFECT ON ARCTIC LAKE SYSTEMS
Principal Investigators: Barsdate, R.J., and V. Alexander
Performing Organization: University of Alaska, Institute of Marine Sciences, Fairbanks, AL 99701
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development
Period: 7/75 to 7/76

The principal investigators propose to investigate the potential effects of an oil spill on a large arctic lake by carrying out an experimental spill and observing the impact and recovery. Initially a pre-spill baseline study will be done on the proposed site. Emphasis will be on the analysis of ecosystem function in order to broaden the applicability of these results to other high latitude aquatic environments.

[SSIE No. GMA-2449-1]

R-155-76
DISTRIBUTION OF SPILLED OIL IN RELATION TO BEACH MORPHOLOGY
Principal Investigator: Hayes, M.O.
Performing Organization: University of South Carolina, School of Arts and Sciences, Administration Building, Room 115, Columbia, SC 29208
Supporting Agency: U.S. National Science Foundation, Division of Advanced Environmental Research and Technology, No. ENV76-06989

Period: 12/75 to 11/76
Funds: $89,600

The objective of this research is to establish a landform-sedimentological classification of the beaches of the Straits of Magellan which were affected by the 1974 "Metula" oil spill, and to measure the distribution of oil along the shore. Other studies will be evaluating the environmental effects of the spill.

[SSIE No. GSQ-1455]

Status: The field work of the Metula oil spill study was carried out in a total of ten weeks between August, 1975, and August, 1976. The purpose of this work is to study a major oil spill as it effects a coastline which is quite similar to parts of the coast of New England and Alaska. A final report is expected to be submitted on November 30, 1976, to the National Science Foundation.

A second project being conducted deals with the "Urquiola" oil spill of May 12, 1976, in La Coruna, Spain. The field work for this project was done between May 18 and June 18, 1976. The object of this study is to delineate the behavior of an ongoing oil spill as it affects rocky headlands, salt beaches and salt marshes of a complex ria system. A final report should be finished by November, 1976.

Reports and Publications

COASTAL GEOMORPHOLOGY AND SEDIMENTATION OF THE METULA OIL SPILL SITE IN THE STRAITS OF MAGELLAN
Hayes, M.O., and E.R. Gundlach. 1975.
Final report (preliminary).

A reconnaissance was made of the "Metula" spill area in August, 1975, to determine coastal morphological similarities between the affected area and future potential spill sites in New England and Alaska. Inside the First Narrows the sediment type and beach morphology show a striking resemblance to the Pleistocene glaciated shoreline of Southern New England and the present glacial shorelines of the south coast of Alaska. Oil was still very much in evidence in the intertidal portions of the shoreline. To date, no in-depth studies have been carried out on the biological and physical impact of the spill. Information gained from such a study would be useful in planning environmental studies related to petroleum transport and terminals in the New England and Alaska areas.

Information Source: A.E. Blount, Department of Geology, University of South Carolina, Columbia, S.C. 29208

R-156-76
POLLUTION AND COMMERCIAL FISHERIES
Principal Investigator: Johnston, R.
Performing Organization: DAFS Marine Laboratory, P.O. Box 101, Victoria Rd., Aberdeen, AB9 8DB, Scotland
Supporting Agency: Unknown
Period: Unknown (continuing)

Reports and Publications (summaries not available)

WHAT NORTH SEA OIL MIGHT COST FISHERIES
Johnston, R.
Rapports et Proces Verbaux. In press.

THE EFFECTS OF OILY WATERS ON MARINE ORGANISMS FROM WATER FOR NORTH SEA OPERATIONS
Johnston, R., and A.D. McIntyre. Date unknown.
Presented at Seminar on the Separation of Oil from Water for North Sea Operations.

Information Source: American Society for Microbiology, Aquatic Microbiology Newsletter 15(2):26. 1976]

R-157-76
OIL AND SEA-ICE PROGRAMS IN THE ARCTIC ISLANDS
Coordinator: A.R. Milne
Performing Organization: Canada, Department of the Environment, Ocean and Aquatic Sciences (OAS), 1230 Government St., Victoria, B.C. V8W 1Y4
Supporting Agencies: Canada, Department of the Environment; Department of Indian Affairs and Northern Development
Period: Unknown (continuing)

Exploratory drilling is underway both offshore and onshore in the islands of the Canadian Archipelago. To determine the magnitude of the impact of possible oil spills, the movement of surface water and sea-ice is being studied and biologically sensitive foci in the central Arctic Islands defined. The program consists of the following components: a study of currents in Penny Strait; under-ice current measurements in Byam and Austin Channels; a contemporary and historical study of ice movements in the central Archipelago using satellite imagery; an analysis of historical oceanographic data; and a definition of wildlife habitat and populations vulnerable to oil contamination.

[A.R. Milne, Department of the Environment, Ocean and Aquatic Sciences. Spill Technology Newsletter 1(4):11. July-August, 1976]

R-158-76

THE LONG-TERM IMPACT OF THE ARROW SPILL

Principal Investigator:	Unknown
Performing Organization:	Bedford Institute of Oceanography, Dartmouth, Nova Scotia B2Y 4A2
Supporting Agency:	Unknown
Period:	Summer, 1976

Six scientists, both from the Bedford Institute of Oceanography as well as from other Canadian and U.S. institutes, have participated in a major collaborative effort to re-examine the long term impact of the 1970 "Arrow" oil spill on the Chedabucto Bay, Nova Scotia environment. Work has shown that the oil stranded onto shorelines is persistent and flow studies suggest that as much as 90,000 gallons of Bunker C oil may still remain on Chedabucto Bay beaches. Efforts of this program are to estimate total amount and composition of Arrow Bunker C still residual within the bay system, evaluate the role of microbial degradation in the deep sediments, evaluate the impact on the biological component of the bay from an ecological and physiological point of view, and study physical modifications of the environment.

[J. Vandermeulen, Bedford Institute of Oceanography. Spill Technology Newsletter 1(3):14-16. May-June. 1976]

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL EFFECTS

R-159-76

TOXIC EFFECTS ON THE AQUATIC BIOTA FROM COAL AND OIL SHALE DEVELOPMENT

Principal Investigator:	Skogerboe, R.K.
Performing Organization:	Colorado State University, School of Natural Sciences, Fort Collins, CO 80521
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development
Period:	6/75 to 5/76
Funds:	$600,000

This research includes an investigation to provide predictive information on the potential toxicants to the aquatic environment resulting from coal and oil shale extraction and conversion. Field and laboratory studies will be conducted to determine the degree to which those chemicals may be toxic to aquatic organisms or may become involved as part of the food chain. Concurrent biological and chemical laboratory and field bioassays as well as aquatic distribution studies will indicate which toxicants are most deleterious to aquatic biota.

[SSIE No. GMA-2476]

2. GENERAL EFFECTS

R-108-76
ECOLOGICAL INVESTIGATION OF ALASKAN NORTH SLOPE OIL FIELD DEVELOPMENT

Principal Investigator:	Hanson, W.C.
Performing Organization:	Los Alamos Scientific Lab., P.O. Box 1663, Los Alamos, NM 87544
Supporting Agency:	U.S. Energy Research and Development Adminstration, Biomedical and Environmental Research Division
Period:	7/74 to 6/75

Studies have been made of existing distributions of birds, small mammals, caribou and the effect of pipeline construction, and cultural implication of oil development on Eskimo and Indian societies along the route. The implications of the changes to human health of inhabitants, transient workers and tourists were be stressed.

[SSIE No. GPE-5706]

Reports and Publications

ECOLOGICAL INVESTIGATIONS OF ALASKAN NORTH SLOPE OIL DEVELOPMENT
Hanson, W.C., and L.E. Eberhardt. 1976.
Biomedical and Environmental Research Program of the LASL Health Division, Progress report LA-6464-PR; ERDA Contract W-7405-ENG. 36. p.32-33.

The study objective is to evaluate the ecological consequences of the construction and operation of the Trans-Alaska pipeline by means of selecting indicator organisms from tundra environments in the vicinity of lands disturbed by exploration, extraction, and transport of North Slope petroleum. Arctic and red fox populations were selected for study. During the past year, 26 arctic fox dens were located in the Prudhoe Bay area, of which 11 were actively used by 9 fox families. An additional 30 arctic and red fox dens were found along a 40-mile segment of the pipeline route. Livetrapping operations resulted in the tagging of 42 foxes. In addition, prey populations of lemmings and shoreline birds are being mapped and counted to determine interactions of the foxes and their alternative food resources. Biological studies on foxes resulted in a large amount of data on arctic and red fox ranges, denning habits, behavior, food habits, etc., that are now being summarized.

Information Source: W.C. Hanson, Los Alamos Scientific Lab,
P.O. Box 1663, Los Alamos, NM 87544

R-160-73

ENVIRONMENTAL IMPACT ASSESSMENT FOR NEW GRASS ROOTS OIL REFINERY

Principal Investigator: Griffin, R.W.
Performing Organization: NUS Corporation, Pittsburgh, PA 15205
Supporting Agency: Hampton Roads Energy Company
Period: 1/75 to 12/75

An environmental impact assessment is being made for the New Grass Roots Oil Refinery.

[SSIE No. BV-362]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-161-76
MICROBIOLOGICAL EFFECTS OF PETROLEUM ACCUMULATION ON BEACHES
Principal Investigator: Colwell, R.R.
Performing Organization: University of Maryland, School of Arts and Sciences, College Park, MD 20742
Supporting Agency: U.S. National Science Foundation, Division of Advanced Environmental Research and Technology, No. ENV76-08310
Period: 3/76 to 2/77
Funds: $92,000

This project is a part of a broader effort to evaluate the effects of oil spilled on different beach types. A huge spill area on the beaches of the Straits of Magellan is being studied. The research will involve sample collection and measurement of oil effects on microorganism populations, evaluation of oil effects on oil-degrading bacteria, and assessment of potential for bacteria to degrade oil.

[SSIE No. GSQ-1516]

R-162-76
NATURAL BIODEGRADATION OF OIL IN AQUEOUS ENVIRONMENTS
Principal Investigator: Colwell, R.R.
Performing Organization: University of Maryland, School of Arts and Sciences, College Park, MD 20742
Supporting Agency: American Petroleum Institute, No. OS-20I
Period: 1/75 to 12/75

The project objectives were to determine the rate and mechanisms of degradation and ultimate fate of oil in the marine environment through the activity of naturally occurring microorganisms, and to identify oil biodegradation products by generic types and determine the percentage of oil components that show little or no attack by microorganisms. All microbiological work on this project has been completed. The final report was due to be completed by March, 1975.

[SSIE No. PAP-108]

R-163-76

HYDROCARBON ACCUMULATION IN SOILS

Principal Investigators:	Degrange, P., J. Greffard, T. Gugalski, M. Bourgeois, and C. Vilbert
Performing Organization:	Ministry of Industry and Research, Bureau of Geol. Mining Res., 45018 Orleans Cedex, B.P. 6009, Paris, France
Supporting Agency:	France. Ministry of Industry and Research
Period:	7/75 to 6/76

The study is an extension of a previous project concerned with the biodegradability of hydrocarbons. The investigators distributed a predetermined amount of oil on a small area of soil and followed it through the course of time, comparing it with a control soil. The following parameters were observed: oil penetration, physical and chemical changes of the soil, microbiological changes.

[SSIE No. BT-929]

R-164-76

Title unknown

Principal Investigator:	Somerville, H.J.
Performing Organization:	Shell Research Ltd., Woodstock Laboratory, Sittingbourne, Kent, U.K.
Supporting Agency:	Unknown
Period:	Unknown

Current research: Environmental microbiology, Hydrocarbon microbiology.

[American Society for Microbiology. Aquatic Microbiology Newsletter 15(1). 1976]

Reports and Publications

DENITRIFICATION AND ALKANE OXIDATION BY PSEUDOMONAS AERUGINOSA

Swain, H.M., J.A. Cole, and H.J. Somerville. 1975.
Society for General Microbiology: Proceedings 3(1):10-11.

When *Pseudomonas aeruginosa* is grown anaerobically with nitrate, octane, and an additional carbon source, the enzymes for octane oxidation are induced. This strain is able to catalyze alkane oxidation and nitrate reduction with a decrease in biomass of the culture.

Information Source: H.J. Somerville, Woodstock Laboratory,
Sittingbourne Research Centre, Sittingbourne,
Kent, U.K. ME9 8AG

R-165-76

BENEFICIAL STIMULATION OF BACTERIAL ACTIVITY IN GROUND WATERS CONTAINING PETROLEUM PRODUCTS

Principal Investigator:	Unknown
Performing Organization:	Sun Ventures Inc., 240 Rodnor Chester Rd., Wayne, PA 19087
Supporting Agency:	American Petroleum Institute, No. OS-21.2
Period:	7/75 to 6/76

Methods of promoting bacterial decomposition of petroleum components in groundwaters are being determined. Completed project No. OS-21.1 indicated that bacterial involvement is widespread in the case of groundwater contamination by petroleum products. Current project OS-21.1 has shown that introduction of oxygen and fertilizer into groundwater was of value in stimulating and promoting the desired bacterial activity on gasoline in a field experiment conducted near Ambler, Pennsylvania.

[SSIE No. PAP-122-1]

R-166-76

MICROBIAL UTILIZATION OF HYDROCARBONS

Principal Investigator:	Westlake, D.W.S.
Performing Organization:	University of Alberta, Department of Microbiology, Edmonton, Alberta, Canada
Supporting Agency:	Unknown
Period:	Unknown (continuing)

Reports and Publications (summaries not available)

MICROBIAL UTILIZATION OF RAW AND HYDROGENATED SHALE OILS
Westlake, D.W.S., W. Belicek, A. Jobson, and F.D. Cook. 1976.
Canadian Journal of Microbiology 22:221-227.

BIODEGRADABILITY OF NORTHERN CRUDE OILS
Westlake, D.W.S., and F.D. Cook. 1976.
Department of Indian Affairs and Northern Development, Ottawa, ALUR Report 1974-75. INA Publication No. QS-8048-000-EE-A1.

Information Source: American Society for Microbiology, Aquatic Microbiology Newsletter 15(2):45. 1976]

2. GENERAL FATE OF OIL

R-109-74 (renewal)
FATE, SPATIAL AND TEMPORAL DISTRIBUTION OF PETROLEUM DERIVED ORGANIC COMPOUNDS IN THE OCEAN AND THEIR SUBLETHAL EFFECTS ON MARINE ORGANISMS
Principal Investigator: Sackett, W.M.
Performing Organization: Texas A and M University System, School of Geosciences, College Station, TX 77843
Supporting Agency: U.S. National Science Foundation, Division of National and International Programs, No. ID073-09739 A02
Period: 1/76 to 12/76
Funds: $49,400

The spatial and temporal distribution of low molecular weight hydrocarbons in the Gulf of Mexico will continue to be studied along with the sub-lethal effect of these compounds on marine organisms. A new aspect of the work will involve studies in and around "underwater flares" of natural gas which are released into the Gulf during oil well drilling operations.

[SSIE No. GSN-1145-3]

R-34-76
TRANSPORT AND DISPERSION OF REFINERY WASTES IN FRESHWATER COASTAL REGIONS
Principal Investigators: Harrison, W., and D. McCown
Performing Organization: Argonne National Laboratory, 9700 So. Cass Ave. Argonne, IL 60439
Supporting Agency: Argonne National Laboratory
Period: 7/75 to 6/76

The study will begin in waters of southern Lake Michigan. The dynamics of oil-fouled lake waters will be examined by tagging water and oily waste with rare earths and by determining down-current concentrations of these elements in water samples subjected to neutron activation.

[SSIE No. BP-163]

Reports and Publications

TRANSPORT AND DISPERSION OF OIL-REFINERY WASTES IN THE COASTAL WATERS OF SOUTHWESTERN LAKE MICHIGAN (EXPERIMENTAL DESIGN--SINKING-PLUME CONDITION)
McCown, D.L., W. Harrison, and W. Orvosh. 1976.
Argonne National Laboratory, Great Lakes Project ANL/WR-76-4. 48p. In press.

This first report of a continuing series is concerned with the design and implementation of a tagging and tracer technique applied over a limited period of time (one day) to the sinking plume emanating from the Indiana Harbor Canal. Deficiencies in the original experimental design are discussed, and recommendations are given for their remedy. More frequent sampling at the South Water Filtration Plant, Chicago, and the use of an underway water-sampling system that will permit sampling coverage farther offshore are the principle improvements required for the 1976/1977 full-scale, sinking plume study.

Information Source: W. Harrison, Argonne National Laboratory,
9700 So. Cass Ave., Argonne, IL 60439

R-122-76

FATE OF OIL IN A WATER ENVIRONMENT: DILUTION STUDY OF A CONTROLLED OIL SPILL

Principal Investigator:	Unknown
Performing Organization:	JBF Scientific Corporation, 2 Jewel Dr., Wilmington, MA 01887
Supporting Agency:	American Petroleum Institute, No. 201-75
Period:	Unknown

This project supplements the University of California study for development of an oil spill mathematical model. Oil spill tests at sea have been designed and conducted in order to obtain physical and chemical data on the dispersion of oil slicks in the water column by natural forces. Several hundred samples were obtained from slicks generated by four contractor planned oil spills and from 1.5 and 3 meter depths in the water column. Selected samples were analyzed by Exxon Research and Engineering Company and Chevron Oil Field Research Company laboratories. A final report containing results of these analyses and other data, correlations, and conclusions will be prepared and submitted.

[Environmental Research, Annual Status Report, API Publication No. 4275. February, 1976]

Reports and Publications

THE GOWANUS CANAL OIL SPILL (newsbrief)
Anon. 1976.
JBF Scientific Corporation, Wilmington, MA. U.S. Coast Guard Contract DOT-CG03-6666.

Approximately 9.8 million liters (2.6 million gallons) of No. 2 and No. 6 fuel oils were spilled at Gowanus Canal. Two oil skimmers manufactured by the JBF Scientific Corporation were used in cleanup operations and recovered over 5.7 million liters (over 1.5 million gallons) of the spilled oil.

JBF DEBRIS HANDLING SYSTEM (product information)
Anon.
JBF Scientific Corporation, Wilmington, MA. U.S. Navy Contract N00600-75-C-0948.

The design and development of a debris handling system for both heavy and light oils with fibrous and hard debris are described. The system has two parts: one is a grinding unit which reduces oil mixtures to a slurry; the other is a clamshell basket crane which collects and removes the processed slurry from the grinder.

THE APPLICATION OF SKIMMERS, PISTON FILMS, AND SORBENTS FOR OPEN WATER SPILLS
Bianchi, R.A., E.E. Johanson, and J.H. Farrell. 1973.
Offshore Technology Conference, 5th, Houston, 1973. OTC Paper No. 1746. 14p.

A series of oil spill cleanup tests were conducted to assess the use of skimmers, piston films, and sorbents. Piston films were effective in preventing the oil from spreading and sorbents made the slick highly visible to the skimmer operator. Skimmers were especially effective on oil escaping from booms, but oil transfer systems were inadequate.

DESIGN, DEVELOPMENT, TEST, AND EVALUATION OF AN OPEN OCEAN OIL RECOVERY SYSTEM FOR USE IN WAVES
Johanson, E.E., R.A. Bianchi, and J.H. Farrell. 1974.
Offshore Technology Conference, 6th, Houston, 1974. OTC Paper No. 1995, Vol. 1:559-576.

A program was established by JBF Scientific to design, build, and test an open sea oil recovery system for high wave conditions. Past massive spills were studied to establish operational requirements for the unit. The first system was built for the U.S. Navy Supervisor of Salvage and tested in April, 1974.

THE DESIGN AND DEMONSTRATION OF A REMOTELY-CONTROLLED HIGH-SEAS OIL RECOVERY SYSTEM
Neal, R.W., R.A. Bianchi, and E.E. Johanson. 1975.
Conference on Prevention and Control of Oil Pollution, San Francisco, 1975. p.395-399.

Results of a program conducted by JBF Scientific Corp. to demonstrate and test a spilled-oil recovery system under offshore conditions are given. A skimmer was designed with complete remote control capability. In a test, a relatively small, unmanned skimmer in remote control successfully recovered oil in sea state 3.

Information Source: R.A. Bianchi, JBF Scientific Corporation,
2 Jewel Dr., Wilmington, MA 01887

R-167-76

OIL SPILL CONCENTRATION PREDICTION

Principal Investigator:	Barrientos, C.
Performing Organization:	U.S. Department of Commerce, Systems Development Office, 8060 13th St., Silver Spring, MD 20910
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development
Period:	7/75 to 6/76
Funds:	$360,000

The contract provides for the development of a numerical model which will predict the concentration of petroleum in the oceans as a function of space and time. Forecast techniques will be developed to predict local current, wind, and wave fields, data which have not previously been available. Physical, dynamical, statistical, and numerical approaches will be used to accomplish the project objective.

[SSIE No. GMA-2340]

R-168-76

COMPUTER MODEL FOR OIL SPILL MOVEMENT IN DELAWARE BAY

Principal Investigator:	Biggs, R.B.
Performing Organization:	University of Delaware, School of Marine Science, Lewes, DE 19958
Supporting Agency:	U.S. National Science Foundation, Division of Advanced Environmental Research and Technology, No. ENV76-10618
Period:	3/76 to 2/77
Funds:	$160,000

This study is a continuation of a project to develop a computer model which predicts the two-dimensional movement of an oil spill in Delaware Bay as a function of space and time. The basic model has already been developed and tested. The remaining research is aimed at incorporating into the model severe wind conditions and behavior of frontals, completing water-oil-emulsification studies and remote sensing studies, and evaluating in terms of spill hazard the different ways of handling incoming oil shipments in lower Delaware Bay.

[SSIE No. GSQ-1522]

Reports and Publications

SPORT FISHING IN WESTERN DELAWARE BAY: ASSESSMENT OF CRITICAL AREAS
Smith, R.W. 1975.
University of Delaware, Final report, CMS-RANN-2-75. 22p.

Because marine sport fishing greatly contributes to the economy and recreation of the Delaware Bay region, a study of fish distributions and densities was conducted to find suitable locations for ship anchorage which would not impair sport fishing. This study was conducted as a part of the project, Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation.

ECOLOGICAL STUDIES ON BENTHIC AND PLANKTONIC ASSEMBLAGES IN LOWER DELAWARE BAY
Author unknown. 1976.
CMS-RANN-3-76. In press.

REMOTE SENSING OF ESTUARINE FRONTS AND THEIR EFFECTS ON POLLUTANTS
Klemas, V., and D. Polis. 1976.
CMS-RANN-4-76. In press.

MODELING OF OIL EVAPORATION IN AN AQUEOUS ENVIRONMENT
Wang, H., W.C. Yang, and C.P. Huang. 1976.
CMS-RANN-5-76. In press.

COMPUTER MODELING OF OIL DRIFT AND SPREADING IN DELAWARE BAY
Wang, H., J.R. Campbell, and J.D. Ditmars. 1976.
University of Delaware, Final report, CMS-RANN-1-76. 58p.

A computer model was developed for the prediction of oil spill dispersion in Delaware Bay. The effect of waves on drifting and spreading, diffusion coefficients of oils, and wind effects are all accounted for in the model. This study was conducted as a part of the project, Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation.

SATURATED HYDROCARBON MATERIAL IN SEDIMENTS OF THE DELAWARE ESTUARY AS DETERMINED BY GAS CHROMATOGRAPHIC ANALYSES
Wehmiller, J.F., and M. Lethan. 1975.
University of Delaware, Final report, CMS-RANN-3-75. 87p.

This report presents a preliminary interpretation of the analysis of hydrocarbon material in sediments of the Delaware estuary as determined by solvent extraction, column chromatography, and gas-liquid chromatography. Thirty-five stations from Philadelphia to the bay mouth have been analyzed. Several stations have been reoccupied and reanalyzed following the oil spill from the "Corinthos" tanker explosion on January 31, 1975; many of these "post-Corinthos" samples are discussed in the appendix to the report.

SEA-SURFACE DRIFT CURRENTS
Wu, J. 1975.
Offshore Technology Conference, 7th, 1975. Paper no. OTC 2294. 8p.

In studies of wind and wave-induced surface drift currents at various fetches, the ratio between the wind-induced drift and the wind velocity was found to decrease with the increasing fetch, while the ratio between the wave-induced drift and the wind velocity was found to increase with the fetch. The total surface drift is almost independent of the wind fetch and is about 35% of the wind velocity at long fetches. This work is a part of the project, Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, sponsored by the National Science Foundation.

Information Source: R.B. Biggs, University of Delaware, College of Marine Studies, Newark, DE 19711

R-169-76
FATE OF PETROLEUM HYDROCARBONS IN THE MARINE FOOD WEB

Principal Investigator:	Lee, R.F.
Performing Organization:	Skidaway Institute of Oceanography, Savannah, GA 31406
Supporting Agency:	U.S. National Science Foundation, Division of Ocean Sciences, No. OCE74-05283 A01
Period:	3/76 to 2/77
Funds:	$57,000

The objective of the proposed research is to further the understanding of the uptake, metabolism, storage, and discharge of petroleum hydrocarbons in marine phytoplankton and zooplankton. The distribution of a hydrocarbon within tissues, induction of hydrocarbon-degrading enzymes after oil exposure, and identification of hydrocarbons by both radiolabeled and non-labeled types in petrogenic metabolites will be studied in four phyla of benthic invertebrates. Microbial degradation work will involve the addition of C-hydrocarbon to inshore and offshore water samples followed by a collection of $^{14}CO_2$ and water soluble products.

[SSIE No. GSN-1508-2]

Reports and Publications

EFFECTS OF FOUR OILS ON COASTAL MARINE BACTERIAL POPULATIONS: A CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Hodson, R.F., F. Azzam, and R.F. Lee. 1977.
Bulletin of Marine Science. In press.

Summary not available.

FATE OF PETROLEUM HYDROCARBONS IN MARINE ZOOPLANKTON
Lee, R.F. 1975.
Conference on Prevention and Control of Oil Pollution,
San Francisco, 1975. p.549-553.

Several groups of zooplankton from the northwest North American coast rapidly took up various hydrocarbons. Crustaceans metabolized these hydrocarbons but jellyfish did not. The benzpyrene ingested by a copepod was depurated to 1 x 10^{-5} μg in 17 days; no further loss occurred.

METABOLISM OF PETROLEUM HYDROCARBONS IN MARINE SEDIMENTS
Lee, R.F. 1977.
Symposium on Sources, Effects and Sinks of Petroleum in
the Aquatic Environments, August 9-11, 1976. Washington,
D.C., American Institute of Biological Sciences. In press.

The paper discusses the importance of microfauna, meiofauna, and macrofauna in the metabolism of sediment hydrocarbons. Hydrocarbon degrading microbes, high in areas of oil input, rapidly degrade the alkanes while more slowly degrading the isoalkanes, cycloalkanes, and aromatic hydrocarbons. Meiofauna and benthic macrofauna expose deeper sediments to the water-sediment interface during the process of feeding and allow for microbial degradation. Active enzyme systems are present in the polychaete worms which metabolize hydrocarbons. Bacteria and animals metabolize aromatic hydrocarbons by different mechanisms with bacteria producing cis-diols while animals degrade them to trans-diols. These compounds are eventually degraded to carbon dioxide or excreted by animals.

PETROLEUM HYDROCARBONS

Lee, R.F. 1976.
Guideline Manual on Use of Bioaccumulators in Monitoring Programmes. J.E. Portmann (ed.). Rome, Italy, Food and Agriculture Organization of the United Nations. In press.

Summary not available.

FATE AND EFFECT OF NAPHTHALENES IN CONTROLLED ECOSYSTEM ENCLOSURES

Lee, R.F., and J.W. Anderson. 1977.
Bulletin of Marine Science. In press.

Approximately 10g of naphthalenes were added to one quarter scale CEPEX enclosure (June, 1975) resulting in a concentration of 160 µg/liter. A control enclosure was established. After one day, the amount of naphthalenes in the water was reduced by 50% and gradually decreased to near background levels in 20 days. The decrease could be accounted for by adsorption to sinking phytoplankton and microbial degradation. An immediate decline in the phytoplankton population in both enclosures was observed, and 3.2g of naphthalenes were associated with the sediment on day 4. Because of this "crash" no studies on naphthalene effects on phytoplankton were made. There was an immediate decrease in ctenophores in the treated enclosure and copepod numbers were comparable in the two enclosures.

METABOLISM OF HYDROCARBONS IN MARINE INVERTEBRATES. ARYL HYDROCARBON HYDROXYLASE FROM THE TISSUES OF THE BLUE CRAB, *CALLINECTES SAPIDUS*, AND THE POLYCHAETE WORM, *NEREIS* SP.

Lee, R.F., E. Furlong, and S. Singer. 1977.
Biological Effects Program Workshop, College Station, Texas, May 16-19, 1976. National Science Foundation/International Decade of Ocean Exploration. In press.

Aryl hydrocarbon hydroxylase was observed in homogenates from the gill, blood, hepatopancreas and green gland of the blue crab and in the stomach and intestine of the polychaete *Nereis virens*. Most of the activity was associated with the microsomes. The enzyme of both organisms was similar to the hydroxylase system of mammals and fish in optima pH and temperature; inhibition by EDTA, detergents, and phospholipase C; induction of activity by benzanthracene; metabolism of benzopyrene; and NADPH, oxygen and magnesium requirements.

BIODEGRADATION OF PETROLEUM HYDROCARBONS BY MARINE MICROBES

Lee, R.F., and C. Ryan. 1976.
Biodeterioration of Materials. J.M. Sharpley and A.M. Kaplan (eds.). Essex, England, Applied Science Publishers, 1976. Vol. 3. In press.

Paraffinic and aromatic ^{14}C-labeled hydrocarbons were added to estuarine and offshore water samples followed by measurement of $^{14}CO_2$ produced after periods of 6 to 96 hours. Degradation rates ranged from 4.4 ug/l/day for naphthalene at 130 ppb to 0.002 ug/l/day for benzpyrene at 5 ppb. High degradation rates were recorded for benzene, toluene, naphthalene, methylnaphthalene, heptadecane, hexadecane, and octadecane. The results support the conclusion that microbes are significant in degrading many petroleum hydrocarbons in marine waters. However, based on low degradation rates of benzpyrene and fluorene, it is hypothesized that microbial breakdown of high molecular weight aromatics is not an important process in water.

FATE OF PETROLEUM HYDROCARBONS TAKEN UP FROM FOOD AND WATER BY THE BLUE CRAB, *CALLINECTES SAPIDUS*

Lee, R.F., C. Ryan, and M.L. Neuhauser. 1976.
Marine Biology. In press.

Radioactive labeled paraffinic and aromatic hydrocarbons were ingested from food and water by the blue crab, *Callinectes sapidus*. Of the radioactivity assimilated, more than 50% was in the hepatopancreas, and after 25 days radioactivity was found only in the hepatopancreas, a possible site for hydrocarbon metabolism. No evidence was found for storage of hydrocarbons and elimination of the hydrocarbons was principally through excretion.

THE FATE AND EFFECT OF PETROLEUM IN CONTROLLED ECOSYSTEM ENCLOSURES

Lee, R.F., and M. Takahashi. 1976.
Rapports et proces-Verbaus des Reunions. Conseil International pour l'Exploration de la Mer. In press. (Workshop: Petroleum Hydrocarbons in the Marine Environment No. 65.)

The addition of No. 2 fuel oil at concentrations of 20 and 40 ppb to experimental enclosures produced major changes in the ecosystems in terms of primary and secondary producers. At the higher concentration microbial degradation increased markedly and after 3 days the naphthalene degradation rate had increased from 0.2 to 2.5 μg/liter/day. The major change in the populations after petroleum addition was a decline in diatoms and an increase in micro-flagellates, tintinnids, and rotifers.

CONTROLLED ECOSYSTEMS: THEIR USE IN THE STUDY OF PETROLEUM HYDROCARBONS ON PLANKTON
Lee, R.F., M. Takahashi, J.R. Beers, W.H. Thomas, D.L.R. Seibert, P. Koeller, and D.R. Green. 1976.
Pollution and Physiology of Marine Organisms. A. Calabrese and J. Vernberg (eds.). New York, Academic Press. In press.

Information Source: R.F. Lee, Skidaway Institute of Oceanography,
P.O. Box 13687, Savannah, GA 31406

R-170-76

FATE AND EFFECTS OF CRUDE OIL SPILLS ON PERMAFROST

Principal Investigators:	McFadden, C., and C. Slaughter
Performing Organization:	U.S. Army Cold Regions Research and Engineering Laboratory, P.O. Box 282, Hanover, NH 03755
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development
Period:	7/75 to 6/76

The ultimate fate, decomposition products, and rate of decomposition will be monitored on 7.6 l to 7600 l (2-2000 gal) crude oil spills on Black Spruce-dominated, permafrost underlain tundra. Degradation by microrganisms, solar radiation, and evaporation will be monitored. Spills will be carried out in winter to determine the interaction of snow and effect of breakup, and in summer to observe the effects of crude oil on foliage.

[SSIE No. GMA-2723]

R-171-76

POROSITY OF MULTI-YEAR ICE

Coordinator:	A.R. Milne
Performing Organization:	Canada, Department of the Environment, Ocean and Aquatic Sciences, Arctic Marine Science Program, Victoria
Supporting Agency:	Canada, Department of the Environment, Environmental Protection Service
Period:	Unknown (continuing)

The permeability of multi-year ice from early to late summer is being investigated. Air is pumped under the ice and its depletion from under ice domes, if any, is observed using an underwater TV camera. A variety of other experiments is underway, all of which should make oil spill contingency plans more realistic in seas where oil can get trapped under multi-year ice. The experiments are being conducted near Byam Martin Island.

[A.R. Milne, Department of the Environment, Ocean and Aquatic Sciences. Spill Technology Newsletter 1(4):12. July-August, 1976]

R-172-76

DEVELOPMENT OF A CHEMICAL, STABILITY, AND TRANSPORT MODEL OF OIL SHALE PROCESS WASTES IN SOIL

Principal Investigators:	Routson, R.C., R.M. Bean, and R.J. Serne
Performing Organization:	Battelle Memorial Institute, P.O. Box 999, Richland, WA 99352
Supporting Agency:	U.S. Energy Research and Development Admin. Biomedical and Environmental Research Division, Contract E (45-1)-1830
Period:	7/75 to 6/76

The source, transport, and physical and chemical reactions, stability, and fate of oil shale process wastes will be investigated and modeled. Batch and column studies will be used to measure the equilibrium and kinetic parameters which control the fate and transport of the wastes and leachates through typical soil systems of oil shale regions. A computer simulation program will be developed to predict pollutant transport through these soils.

[SSIE No. ZPE-11372]

R-173-76

FIGHT AGAINST POLLUTION-SPREAD OF HYDROCARBON LAYERS

Principal Investigator:	Unknown
Performing Organization:	French Institute of Petroleum, 1-4 Ave. de Boispreau, Rueil Malmaison, France 92502
Supporting Agency:	France. French Institute of Petroleum
Period:	7/75 to 6/76

An oil spring yields a given quantity of crude oil, and the pollutant hydrocarbons thus accumulated spread very rapidly to the water surface and are carried in one or more directions by winds and currents. The project objective is to estimate the spread of hydrocarbon layers in oceans under the effect of winds and currents using mathematical models.

[SSIE No. BT-991]

R-174-76

POLAR PACK EXPERIMENT IN THE SOUTHERN BEAUFORT SEA

Principal Investigator:	Unknown
Performing Organization:	Norcor Engineering and Research Ltd., Yellowknife, N.W.T. XOE 1H0 Canada
Supporting Agencies:	Environmental Emergency Branch, Environmental Protection Service, and Ocean and Aquatic Sciences, Fisheries and Marine Service, Department of the Environment
Period:	11/75 to 3/76

The aim of the project is to improve the prediction of the large scale movement of oil spills in the transitional ice zone between the stationary landfast ice near shore and the moving permanent polar pack ice further offshore. A field camp on a small island in the seasonal polar pack ice zone of the south-east Beaufort Sea was manned by NORCOR personnel with helicopter support between mid-November, 1975, and March, 1976 (except for a period between December and January). As "ground truth" data was being acquired, additional information from NOAA and NASA satellites and the AIDJEX program was collected. A final report was planned by August, 1976.

[W.J. Logan. Environmental Protection Service, Environmental Emergency Branch. Spill Technology Newsletter 1(4):16. July-August, 1976]

R-175-76

ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF OIL MOVEMENT DUE TO A CURRENT UNDER UNIFORMLY THICK ICE

Principal Investigators:	Uzuner, M.S., R.P. Voelker, and F.B. Weiskopf
Performing Organization:	Arctec Inc., 9104 Red Branch Rd., Suite 255, Ellicott City, MD 21045
Supporting Agency:	U.S. Environmental Protection Agency, National Environmental Research Center, Contract 68-03-2232
Period:	7/74 to 6/75
Funds:	$55,000

Research is directed at developing a full-scale prediction model of the behavior of oil under an ice cover in the presence of flowing water. A series of model tests are planned in ARCTEC's Ice Flume located in a refrigerated laboratory in order to obtain a full-scale prediction of oil transport under ice. Knowledge in this area is needed so that necessary safeguards can be installed and plans initiated should an oil leak occur during petroleum activities in cold regions.

[SSIE No. GMA-2410]

The research program was completed in December, 1975. The draft final report is still under review by the Environmental Protection Agency and therefore is not yet available to the public.

Reports and Publications

OIL SLICK SPREADING BENEATH A UNIFORM ICE COVER IN THE PRESENCE OF A CURRENT
Weiskopf, F.B., and M.S. Uzuner. 1977.
To be presented at Oil Spill Conference, New Orleans, March, 1977.

Previous studies of oil spill extent and spreading rates conducted in still water beneath solid ice indicated that a spreading oil slick passes through three distinct phases: a gravity inertia phase, viscous-gravity phase, and viscous-surface tension phase. This study, which incorporated into the system a steady current of water beneath the ice cover and used crude oil and No. 2 fuel oil in tests, indicates that a fourth phase of spreading motion occurs in the presence of a current. This phase was identified as a turbulent drag-viscous drag phase. Based on test data, a first approximation predictor equation was developed for predicting the spreading of oil beneath uniform ice cover in the presence of a current.

Information Source: L.A. Schultz, Arctec, Inc., 9104 Red Branch Rd., Columbia, MD 21045

SECTION III: CURRENT CONFERENCES

*Additional information not available at time of publication

Aug. 29-
Sept. 3 American Chemical Society Centennial Meeting (172nd National Meeting), San Francisco, 1976.

Oil Pollution Related Papers

Division of Analytical Chemistry
General Session - Liquid Chromatography

Paper 45
AN ANALYTICAL SCHEME FOR THE SYSTEMATIC INVESTIGATION OF THE BIODEGRADATION OF PETROLEUM
Petrakis, L., D.M. Jewell, and W.F. Benusa

Division of Environmental Chemistry
General Session

Paper 14
STATE OF THE ART CHROMATOGRAPHIC TECHNIQUES APPLIED TO THE ANALYSIS OF HYDROCARBONS IN MARINE TISSUES
May, W.E., S.A. Wise, S.N. Chesler, B.H. Gump, and H.S. Hertz

Symposium on Polymers with Environmental Applications

Paper 35
SEABOOM (TM), A PERMANENT OIL CONTAINMENT BARRIER
Tedeschi, E.T.

Paper 60
PRESERVATION OF PHENOLIC COMPOUNDS IN WASTE AND SURFACE WATERS
Carter, M.J., and M. Huston

Division of Fuel Chemistry
Symposium on Oil Shale, Tar Sands, and Related Materials - Supporting Research for Fossil Fuel Extraction

Paper 40
SIMULATED GROUND WATER LEACHING OF IN SITU RETORTED OR BURNED OIL SHALE
Parker, H.W., R.M. Bethea, N. Guren, M.N. Gazdar, and J.K. Owusu

General Session - Analysis and Structure

Paper 53
SEPARATION AND ANALYSES OF PETROLEUM RESIDUES
McKay, J.F., P.J. Amend, P.M. Harnsberger, T.E. Cogswell, and D.R. Latham

Division of Industrial and Engineering Chemistry
Symposium on Transfer of Chemical Pollutants between Air and Water

Paper 23
MASS TRANSFER OF LOW SOLUBILITY MATERIALS ACROSS AN AIR-WATER INTERFACE
McKay, D., and Y. Cohen

Symposium on Instrumentation for Pollution Control Monitoring -- Water Pollution

Paper 96
OIL-IN-WATER MONITORING ABOARD TANKERS
Berto, F.J.

Division of Microbial and Biochemical Technology
General Session

Paper 60
A PRELIMINARY STUDY OF APPLYING DESULFOVIBRIO GROWTH TO OIL SHALE RETORT WATER FOR ELIMINATION OF ORGANIC AND INORGANIC CONTAMINANTS
Findley, J.E., W.H. Wong, and T.F. Yen

Paper 61
BIODEGRADATION OF THE ORGANIC CONTAMINANTS IN OIL SHALE RETORT WATER
Kime, K.E., W.H. Wong, T.G. Anyong, J.E. Findley, and T.F. Yen

Division of Petroleum Chemistry, Inc.
Symposium on Microbiological Processes in Petroleum

Paper 1
MICROBIAL ALTERATION OF CRUDE OIL
Winters, J.C.

Paper 2
MICROBIAL DEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS
Gibson, D.T.

Paper 3
FATE OF POLYCYCLIC AROMATIC HYDROCARBONS IN NATURE
McAuliffe, C.D.

FFI contact Meetings Department, American Chemical Society, 1155 16th St. NW, Washington, D.C. 20036.

*Sept. 6-8 Water Research Centre: Groundwater Quality-Measurements, Prediction, Protection, Reading University, United Kingdom, 1976.

FFI contact Conference Organizer, WRC Medmenham Laboratory, Henley Rd., Medmenham, P.O. Box 16, Marlow, Bucks SL7 2HD, U.K.

Sept. 13-24 Joint Oceanographic Assembly, Edinburgh, Scotland, 1976. Sponsored by the Royal Society of Edinburgh.

The scientific program included six general symposia on oceanography, marine life and the marine environment, and 11 specialized symposia covering various topics. Symposium S-8, entitled Ocean Engineering (I.G.A. Heyning, convenor), covered topics on marine pollution prevention and environmental parameters.

FFI contact the Organizing Committee, Joint Oceanographic Assembly 1976, The Royal Society of Edinburgh, 22 George St., Edinburgh EH2 2PQ, Scotland, U.K.

*Sept. 20-25 Consultative Meeting of Contracting Parties to the Convention on Prevention of Marine Pollution by Dumping Wastes and Other Matter, 1st, London, 1976.
Sponsored by the Intergovernmental Maritime Consultative Organization.

FFI contact the Intergovernmental Maritime Consultative Organization, 101-104 Picadilly, London W1V 0AB England, U.K.

*Sept. 21-24 Offshore North Sea Technology Conference and Exhibition, 2nd, Stavanger, Norway, 1976.

FFI contact NOROIL Publishing House, Conference Department, P.O. Box 480, 4001 Stavanger, Norway.

*Sept. 22-24 Joint Conference on Models in Air and Water Pollution, London, 1976.
Sponsored by United Kingdom Institute of Measurement and Controls, and Koninklijk Institut van Ingenieurs/Netherlands.

FFI contact Institute of Measurement and Control, 20 Peel Street, London W87PD. England, U.K.

*Sept. 22-24 International Association of Drilling Contractors Annual Meeting, New Orleans, Louisiana, 1976.

FFI contact the International Association of Drilling Contractors, 7500 Harwin Drive, Suite 305, Houston, TX 77036.

Sept. 27-29 Conference on Aquatic Pollutants and Biological Effects with emphasis on Neoplasia, New York City, 1976. Sponsored by the New York Academy of Sciences.

The conference focused on marine contamination, its effects on fish and humans, and environmental health requirements.

Oil Pollution Related Papers

Introductory Remarks

OVERVIEW ON AQUATIC POLLUTANTS AND THEIR BIOLOGICAL EFFECTS
Kraybill, H.F.

Summary not available.

Session: Biological Effects of Pollutants

Paper 8
EFFECTS OF MICROBIAL ACTIVITY ON AQUATIC POLLUTANTS
Voll, M.J., J. Isbister, L. Isaki, M. McCommas, and R.R. Colwell

The rate of physical and microbial degradation of crude and refined oils in estuarine and marine environments depends on such parameters as microbial species, geographic area, climate and temperature. The present study is concerned with the possible production of carcinogens and mutagens during physical weathering and biodegradation of oil. Preliminary findings indicate the presence of mutagens in the heavily oil-polluted waters and sediments of Chesapeake Bay; however, under controlled laboratory conditions biodegradation of oil extracts has not resulted in detectable mutagenic activity.

Session: Neoplasms in Aquatic Animals-1

Paper 20

TISSUE LESIONS OF TIGER SALAMANDERS (AMBYSTOMA TIGRINUM): RELATIONSHIP TO SEWAGE EFFLUENTS

Rose, F.L.

Larval tiger salamanders inhabiting a sewage lagoon were found to have an exceptionally high rate of spontaneous tissue lesions. In contrast, no neoplasms were detected on larvae sampled from non-sewage lagoons. Analyses of polycyclic aromatic hydrocarbons revealed traces of benzo(a)pyrene in the sludge; and a high concentration of perylene (300 ppb), a constituent of jet fuel, was detected. As a result of this study, it is suggested that perylene be retested as a possible tumorigenic agent in non-mammalian species.

Session: Neoplasms in Aquatic Animals-II

Paper 28

MARINE ANIMAL NEOPLASMS ASSOCIATED WITH OIL POLLUTION

Yevich, P.P., and C.A. Barszcz

"Soft shell clams, *Mya arenaria*, from various coastal areas of the United States have been examined since 1967. Neoplasms were observed only in animals collected from oil spill sites in Maine. The first tumors, as reported by Barry and Yevich, were discovered in soft shells collected from a chronic JP5 and #2 fuel oil spill site at Long Cove, Searsport, Maine, in 1971. These tumors were malignant and of gonadal origin. In all subsequent surveys, this type of tumor was found in animals from almost all stations examined with incidences of tumors ranging from 2-26%. However, since the 1974-75 survey, animals from one station which had previously developed gonadal tumors, now had hemopoietic tumors of connective tissue origin. At Harpswell, Maine, the site of a chronic JP4 oil spill, soft shell clams have been examined periodically since 1973. An incidence of 14-29% of hemopoietic tumors was found in these clams."

Session: Biological Effects-Marine Animals-Health Implications-Man

Paper 30

THE METABOLIC FATE OF AROMATIC HYDROCARBONS IN MARINE ORGANISMS

Malins, D.C.

It is now recognized that marine organisms of great phylogenetic diversity (excluding phytoplankton and certain molluscs) convert oil components such as naphthalene and benzo[a]pyrene to hydroxylated derivatives during metabolic processes. These metabolic conversions lead to the formation of conjugates, such as glycosides, sulfates, mercapturic acid and glucuronic acid derivatives. The presence of PCB contaminants may influence metabolic regulation of aromatic hydrocarbons in marine fish and thus alter their toxic effects.

Paper 32

IN VITRO METABOLISM OF ORGANIC POLLUTANTS IN SOME MARINE ANIMALS

Bend, J.R., M.O. James, and P.M. Dansette

Marine animals are exposed to a variety of hydrocarbons introduced into the marine environment by offshore drilling and production activity, tanker accidents and discharges, leakage and natural seeps. The ability of marine species to metabolize such hydrocarbons, especially polycyclic aromatic hydrocarbons, into excretable or activated products is an important factor in the disposition and possible toxic effects of these substances. This paper summarizes the findings concerning the activity, inducibility, and tissue distribution of microsomal mixed-function oxidase (MFO) activity of selected marine vertebrates and invertebrates using benzo(a) pyrene, benzphetamine and 7-ethoxycoumarin substrates. In addition, the biotransformation of alkene and arene oxides by epoxide hydrase or glutathione S-transferases, and the effects of fish pretreatment with 3-methylcholanthrene (3-MC) on MFO and epoxide-metabolizing enzyme activities in two Florida marine species are described.

FFI contact the New York Academy of Sciences, 2 East Sixty-third Street, New York, NY 10021.

Sept. 27-
Oct. 1

International Ocean Development Conference and Exhibition, 4th, Tokyo, Japan, 1976.

The theme of the conference was "Man and the Sea-Development in Harmony" and included topics on technology for monitoring and control of oil pollution. The Exhibition featured displays on prevention and control of marine pollutants including oil fences and booms, oil skimmers, and measuring and monitoring systems.

FFI contact the Secretariat, International Ocean Development Conference and Exhibition, c/o Japan Management Association, 1-22, 3-chome, Shiba-Koen, Minato-ku, Tokyo, 105 Japan.

Oct. 3-8

Water Pollution Control Federation Conference, 49th, Minneapolis, Minnesota, 1976.

Oil Pollution Related Papers

Session 7. Control and Treatment of Urban and Rural Surface Runoff

MITIGATION OF POLLUTANTS IN RUNOFF FROM HIGHWAY SOURCES
Howell, R.B., and E. Shirley

Session 17. International Session

MARINE ECOLOGY AND OIL POLLUTION - THE WORK OF THE OIL POLLUTION RESEARCH UNIT
Baker, J.

Session 29. Industrial Wastes Research

REMOVAL OF EMULSIFIED OIL WITH ORGANIC COAGULANTS AND DISSOLVED AIR FLOTATION
Luthy, R.G., R.E. Selleck, and T.R. Galloway

PETROLEUM HYDROCARBONS IN DIGESTED SEWAGE SLUDGES
Liu, D.

FFI contact the Water Pollution Control Federation, 2626 Pennsylvania Avenue NW, Washington, DC 20037.

Oct. 4-6 Canadian Chemical Engineering Conference, 26th, Toronto, Canada, 1976. Sponsored by the Canadian Society of Chemical Engineers.

Environmental topics included paper(s) on treatment of liquid and solid wastes and sublethal toxicity of treated oil refinery wastes.

FFI contact the Canadian Society of Chemical Engineers, 151 Stater Street, Suite 906, Ottawa, Ontario KIP 5H3 Canada.

*Oct. 4-7 World Offshore Exhibition and Conference, London, 1976. Sponsored by the London Chamber of Commerce and Industry.

FFI contact Mr. Dermot B. Graham, Fairs and Exhibition Ltd., 21 Park Square East, Regent's Park, London NW1 4LH, England, U.K.

*Oct. 19 New Jersey and Eastern Pennsylvania Water Pollution/Treatment/Test Seminar, Cherry Hill, New Jersey, 1976.

The meeting and workshop included 16 papers and 4 workshops, several of which covered various aspects of oil pollution.

FFI contact Mr. W.B. Rossnagel, President Rossnagel and Associates, Headquarters Division, 1990 Route 70, Cherry Hill, NJ 08003.

*Oct. 26-30 Antipollution '76, Milan, Italy, 1976.

FFI contact Presidence, Comis, Via Boccaccio 7, 20123 Milan, Italy.

*Nov. 9-11 International Pollution and Engineering Exposition and Congress, 5th, Anaheim Convention Center, California, 1976.

Exhibits will include oil pollution control equipment such as oil skimmers; booms and adsorbents; wastewater treatment systems; and a wide array of instruments, accessories, and services for the prevention, control, and monitoring of all types of pollutants. The congress will consist of a total of 30 sessions.

Oil Pollution Related Papers

Session 6:

THE U.S. ENVIRONMENTAL PROTECTION AGENCY: 1976 ENFORCEMENT PROGRAMS
De Falco, P.,Jr., and H.E. Smith

Session 7:

REDUCING THE RISKS FROM PLANT-PRODUCED SPILLS
Meinhold, T.F.

CONSTRUCTING A SPILL PREVENTION PLANT IN COMPLIANCE WITH EPA REGULATIONS
Weiss, W.H.

A SYSTEMS APPROACH TO REDUCING AND HANDLING IN-PLANT BULK LIQUID TERMINAL PETROCHEMICAL SPILLS
Hooper, M.

Session 12

TRAINING TO ALERT PLANT EMPLOYEES TO AVOID POLLUTANT HAZARDS
Ross, W.K.

Session 17

NATIONAL ENVIRONMENTAL OBJECTIVES AND PROGRAMS
Young, R.A., and J. Quarles

FFI contact Clapp and Poliak, Inc., 245 Park Ave.,
New York, NY 10017.

Nov. 10-12	Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Seattle, Washington, 1976. Sponsored by the U.S. Environmental Protection Agency, and NOAA's Outer Continental Shelf Environmental Assessment Program.

The symposium will focus on the distribution and effects of petroleum hydrocarbons in marine ecosystems, especially in the cold-water regimes of arctic to subarctic latitudes. Papers will be presented on physical distribution and transport of petroleum in the marine environment, biological accumulation, turnover and metabolism of petroleum hydrocarbons by marine organisms, and acute toxicity and sublethal effects of petroleum exposure to marine organisms.

Oil Pollution Related Papers

Plenary Session: Inputs and Physical Transport of Petroleum

OIL SPILLS IN THE ALASKAN COASTAL ZONE - THE STATISTICAL PICTURE
Harrald, J.R., and C.C. Bates

HYDROCARBONS IN THE WATER COLUMN
Shaw, D.G.

OIL SLICK MOVEMENT IN ALASKAN WATERS
Kinney, P.J.

OIL SLICK WEATHERING
McAuliffe, C.D.

Plenary Session: Bioaccumulation and Biotransformations of Petroleum Hydrocarbons

BIODEGRADATION OF AROMATIC PETROLEUM HYDROCARBONS
Gibson, D.T.

BIOCONVERSIONS AND METABOLISM OF PETROLEUM HYDROCARBONS
Malins, D.C.

ACCUMULATION AND TURNOVER OF HYDROCARBONS IN MARINE ORGANISMS
Lee, R.F.

FOOD WEB TRANSPORT OF PETROLEUM HYDROCARBONS
Teal, J.

Plenary Session: Biological Effects of Petroleum Hydrocarbons in Marine Systems

COMPARATIVE TOXICITIES OF PETROLEUM HYDROCARBONS IN MARINE ORGANISMS
Rice, S.D.

SUBLETHAL EFFECTS OF PETROLEUM HYDROCARBONS
Anderson, J.

MORPHOLOGICAL ABNORMALITIES PRODUCED BY HYDROCARBON EXPOSURE
Hawkes, J.

ECOLOGICAL EFFECTS OF PETROLEUM IN MARINE SYSTEMS
Michael, A.P.

Session A-1: Biological Effects

FUEL OILS: EFFECTS OF WATER-SOLUBLE EXTRACTS ON MICROALGAE
Batterton, J., K. Winters and C. Van Baalen

MARINE PHYTOPLANKTON AND PETROLEUM: INFLUENCE ON GROWTH RATES, CHLOROPHYLL LEVELS AND RECOVERY FROM TOXIC EFFECTS
Mills, E.R.,Jr., and S.M. Ray

PRELIMINARY RESULTS OF STUDIES ON THE TOXICITY AND EFFECTS OF PETROLEUM HYDROCARBONS ON MARINE PHYTOPLANKTON IN ALASKAN COASTAL WATER
Alexander, V.

EFFECTS OF CERTAIN PETROLEUM PRODUCTS ON REPRODUCTION AND GROWTH OF ZYGOTES AND JUVENILE STATES OF THE ALGA, FUCUS EDENTATUS DE LA PYL
Steele, R.L.

EFFECTS OF TEMPERATURE ON ACUTE TOXICITY OF BENZENE, NAPHTHALENE, AND THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL TO PINK SALMON, SCALLOPS AND SHRIMP
Korn, S., D.A. Moles, and S.D. Rice

THE EFFECTS OF NUMBER 2 FUEL OIL AND A SIMULATED REFINERY EFFLUENT ON THE GRASS SHRIMP AND THE PINFISH
Hall, L.W.,Jr., A.L. Buikema, Jr., and J. Cairns,Jr.

EFFECT OF CRUDE OIL ON TROUT REPRODUCTION
Hodgins, H.O., W.D. Gronlund, J.L. Mighel, J.W. Hawkes,and P.A. Robisch

THE EFFECT OF NAPHTHALENE ON SURVIVAL AND PROTEIN SYNTHESIS IN BERING SEA FISHES
DeVries, A.L.

THE LOCOMOTOR AND ORIENTATION RESPONSE BY TWO SPECIES OF FISH AND THE SEA TURTLE TO THE WATER SOLUBLE FRACTION OF LOUISIANA CRUDE (API REF. OIL NO. 2)
Kleerekoper, H.

THE EFFECTS OF OIL CONTAMINATION ON THE CONDUCTANCE OF MARINE MAMMAL PELTS, ESPECIALLY FUR SEALS, AND ITS EFFECTS ON DIVING BEHAVIOR
Kooyman, G.L.

EFFECTS OF EXTERNAL APPLICATIONS OF CRUDE OIL ON HATCHABILITY OF MALLARD EGGS
Albers, P.H.

EFFECTS OF EXTERNAL APPLICATIONS OF OIL ON THE EGGS OF THE COMMON EIDER (SOMATERIA MOLLISSIMA)
Szaro, R.C.,and P.H. Albers

Session A-2: Biological Effects

THE EFFECT OF PETROCHEMICALS ON THE SURVIVAL AND LIFE HISTORY OF FIVE SPECIES OF POLYCHAETOUS ANNELIDS
Carr, R.S., and D.J. Reish

CYTOLOGICAL DAMAGE IN MERCENARIA MERCENARIA EXPOSED TO PHENOL
Fries, C.R. and M.R. Tripp

THE EFFECTS OF CHRONIC EXPOSURE OF NO. 2 FUEL OIL ON HATCHING, GROWTH, DEVELOPMENT RATE AND RESPIRATION OF LIMULUS POLYPHEMUS
Laughlin, R.B,Jr., and J.M. Neff

EFFECTS OF DISPERSED CRUDE OILS UPON THE RESPIRATORY METABOLISM OF AN ARCTIC MARINE AMPHIPOD ONISIMUS AFFINUS
Percy, J.A.

TOXICITY OF PETROLEUM TO ARCTIC AMPHIPODS
Busdosh, M., and R.M. Atlas

TOXICITY AND PHYSIOLOGICAL EFFECTS OF PETROLEUM HYDROCARBONS ON ESTUARINE GRASS SHRIMP PALAEMONETES PUGIO
Tatem, H.W.

EFFECTS OF SEAWATER-SOLUBLE FRACTION OF ALASKAN CRUDE OIL AND SELECTED CHEMICAL COMPONENTS ON THE LARVAL STATES OF THE DUNGENESS CRAB, CANCER MAGISTER, DANA
Caldwell, R.S., E.M. Calderone, and M.H. Mallon

EFFECTS OF CRUDE OIL EXPOSURE ON KING CRAB (PARALITHODES CAMTSCHATICA) GILL MORPHOLOGY
Smith, M.A., and M.B. Bonnett

EFFECTS OF COOK INLET CRUDE OIL WATER-SOLUBLE FRACTION ON SURVIVAL AND MOLTING OF KING CRAB (PARALITHODES CAMTSCHATICA) AND COONSTRIPE SHRIMP (PANDALUS HYSSINOTUS) LARVAE
Mecklenburg, T.A., S.D. Rice, and J.F. Karinen

METHODS DEVELOPMENT AND INITIAL EVALUATIONS OF CRUDE OIL FLOW-THROUGH BIOASSAYS WITH FIRST THROUGH FOURTH-STAGE LARVAL LOBSTERS HOMARUS AMERICANUS
Forns, J.M.

RESPONSE OF THE CLAM *MACOMA BALTHICA* (L), EXPOSED TO PRUDHOE BAY CRUDE OIL AS UNMIXED OIL, WATER-SOLUBLE FRACTION, AND SEDIMENT-ADSORBED FRACTION IN THE LABORATORY.
Taylor,T.L., J.F. Karinen, and H.M. Feder

Session B-1: Bioaccumulation and Metabolism

STUDIES ON PETROLEUM BIODEGRADATION IN THE ARCTIC
Atlas, R.M.

ARCTIC HYDROCARBON BIODEGRADATION
Arhelger, S.D., B.R. Robertson, and D.K. Button

PETROLEUM BIODEGRADATION POTENTIAL IN WATERS OF THE SOUTH BEAUFORT REGION OF THE ARCTIC OCEAN
Bunch, J.N.

IMPACT OF SURFACE ADSORBED PETROLEUM HYDROCARBONS ON ORGANISMS
Ho, C.L., and T. Karim

BIOAVAILABILITY OF SEDIMENT-SORBED NAPHTHALENES TO THE SIPUNCULID WORM, *PHASCOLOSOMA AGASSIZII*
Anderson, J.W., and L.J. Moore

UPTAKE AND METABOLISM OF HYDROCARBONS BY COPEPODS
Harris, R.P.

THE UPTAKE OF PETROLEUM HYDROCARBONS BY THE CLAM, *RANGIA CUNEATA*, UNDER VARYING CONDITIONS OF TEMPERATURE AND SALINITY
Fucik, K.W., J.M. Neff, and M.L. Byington

THE CHEMICAL ACCUMULATION AND DEPURATION OF NO. 2 FUEL OIL BY THE SOFT SHELL CLAM, *MYA ARENARIA* L.
Stainken, D.M.

EFFECTS OF CHLORINATED BIPHENYLS ON THE INDUCTION OF ARYL HYDROCARBON HYDROXYLASE BY PETROLEUM HYDROCARBONS
Gruger, E.H., and M.M. Wekell

THE FATE OF PETROLEUM HYDROCARBONS FROM A NO. 2 FUEL OIL SPILL IN A SEMINATURAL ESTUARINE ENVIRONMENT
Bieri, R.H., and V. Stamoudis

EFFECT OF DRILLING OPERATIONS ON THE HYDROCARBON CONTENT OF CRUSTACEANS
Meyers, P.A.

EFFECT OF OIL DISPERSANTS AND CRUDE OIL-DISPERSANT MIXTURES ON HEART RATE OF RESTING FISH (TAUTOGALOBRUS ADSPERSUS)
Kiceniuk, J.W.

Session B-2: Measurement and Movement of Hydrocarbons

DETERMINATION OF NAPHTHALENES IN MARINE SAMPLES USING HPLC
Warner, J.C.

INTERLABORATORY CALIBRATION FOR THE ANALYSIS OF PETROLEUM LEVELS IN SEDIMENT
Wise, S.A., S.N. Chesler, H.S. Hertz, and W.E. May

CRITERIA FOR IDENTIFICATION OF SOURCES OF HYDROCARBON POLLUTANTS
Reed, W.D., and I.R. Kaplan

STABLE CARBON ISOTOPE RATIOS IN BIOTA AND SEDIMENTS FROM LAKE MARACAIBO, VENEZUELA
Templeton, W.L., and R.M. Bean

DETERMINATION OF THE LEEWAY OF OIL SLICKS
Smith, C.L.

EVAPORATION AND SOLUTION OF C1-C10 HYDROCARBON FROM CRUDE OILS ON THE SEA SURFACES
McAuliffe, C.D.

INPUT OF LOW-MOLECULAR WEIGHT HYDROCARBONS FROM PETROLEUM OPERATIONS INTO THE GULF OF MEXICO
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Session B-3: Hydrocarbon Distributions

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LACK OF CORRELATION BETWEEN GAS-LIQUID CHROMATOGRAPHY AND UV ABSORPTION INDICATORS OF PETROLEUM POLLUTION IN ORGANISMS
Zsolnay, A.

*Nov. 8-10 Regional Marine Oil Pollution Conference-Australia, Brisbane, Australia, 1976.
Sponsored by the Australian Government Department of Transportation, the Petroleum Institute Environmental Executive, and the Queensland Government Department of Harbours and Marine.

FFI contact the A.L. Matzkows, Secretary, PIECE, P.O. Box 740, North Sydney, N.S.W., Australia 2060.

*Nov. 11-13 SNAME Annual Meeting, 84th, New York, 1976.
Sponsored by the Society of Naval Architects and Marine Engineers.

Topics will include offshore terminals and marine pollution abatement.

FFI contact Mr. R.G. Mende, Society of Naval Architects and Marine Engineers, 74 Trinity Place, New York, NY 10006.

Nov. 14-19 International Symposium on Industrial Wastes and Environment, Caracas, Venezuela, 1976.

Oil Pollution Related Papers

HYDROCARBON WASTES AND ENVIRONMENT
Weaver

SEA POLLUTION BY HYDROCARBONS
Gould, J.R.

FFI contact Dr. Richard Abbou, Secretariat International, International Association of Medicine and Biology of the Environment, 115 rue de la Pompe, 75116 Paris, France.

Nov. 15-17 Workshop on Oil Spill Prevention, Control, and Cleanup, East Brunswick, New Jersey, 1976.
Sponsored and organized by the U.S. Environmental Protection Agency.

This seminar and workshop for industrial managers and government personnel includes the following topics: magnitude of problem (source and cause of spills, fate and effects, etc.); legislation; spill prevention; role of on-scene commander; containment and recovery of floating oil; field demonstration of booms and skimmers; chemical spill control agents; disposal of recovered oily material; shoreline protection and restoration; personnel training.

FFI contact the Center for Professional Advancement, P.O. Box H, East Brunswick, NJ 08816.

Nov. 15-20 Effluent and Water Treatment Exhibition and Convention, National Exhibition Center, Birmingham, United Kingdom, 1976.

The exhibition deals principally with the treatment of industrial waste effluents, with emphasis on chemical, mechanical and biological wastewater treatment systems. Exhibits will include wastewater treatment facilities and systems for analysis, detection, sampling and monitoring of wastewaters and their components. Oil separation and removal equipment is also featured. The conference contains applied research papers dealing primarily with industrial waste treatment.

Oil Pollution Related Papers

Session 2: Industrial Applications

Paper 5
PETROCHEMICAL WASTES TREATMENT
(author unknown)

FFI contact The Municipal Agency Limited, Effluent and Water Treatment Exhibition, 178-202 Great Portland Street, London, W1N 6NH England, U.K.

*Nov. 23-24	Oil Spill Control and Prevention Workshop, Thunder Bay, Ontario, 1976. The workshop will emphasize oil pollution problems peculiar to northern Ontario. FFI contact Mr. Nick Vanderkooy, Regional Environmental Emergency Coordinator, Environmental Protection Service, Ontario Region, 135 St. Clair Ave. W., Toronto, Ontario M4V 1P5, Canada.
*Nov. 24-26	Coastal Society Conference, 1st, Washington, DC, 1976. The topic of the conference will be outer continental shelf oil leasing policies. FFI contact the Coastal Society, P.O. Box 34405, Bethesda, MD 20034.
*Nov. 28 - Dec. 2	American Institute of Chemical Engineers Annual Meeting, 69th,Chicago, Illinois, 1976. Topics include papers on fuels and petrochemicals, materials engineering and sciences, environmental protection and pollution. FFI contact Mr. D.T. Wasan, Illinois Institute of Technology, IIT Center, Chicago, IL 60616.
*Dec. 6-10	International Congress on the Environment, Paris, 1976. FFI contact International Congress on the Environment, 40 rue du Colisec, 75008 Paris, France.
*Dec. 7-10	Offshore International Exhibition and Conference, Birmingham, England, 1976. Sponsored by the Institute of Petroleum Society of Underwater Technology and other organizations. FFI contact Nigel Keenlyside, Sales Manager, Industrial and Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull, West Midlands B91 2BG, England, U.K.

*Dec. 7-11	International Exhibition of Air, Noise, Waste and Water Techniques and the Control of Industrial and Urban Pollution, 1st, Paris, France, 1976. FFI contact TECHNOEXPO, 8 rue de la Michodiere, 75002 Paris, France.

1977

*January	International Symposium on Marine Pollution Research, Gulf Breeze, Florida, 1977. Sponsored by the U.S. Environmental Protection Agency Office of International Affairs. FFI contact D.G. Ahearn, School of Arts, Georgia State University, Atlanta, GA.
*Jan. 11-12	ASTM Symposium on Chemical Dispersants for the Control of Oil Spills, Dallas, Texas, 1977. FFI contact American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.
Feb. 28-March 4	Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, 28th, Cleveland, Ohio, 1977. All aspects of analytical chemistry and spectroscopy will be covered including techniques for trace analysis of organic materials and oil spill identifcation. FFI contact John Graham, Program Chairman, Koppers Co., Inc., 440 College Park Drive, Monroeville, PA 15146.
Mar. 8-10	Conference on the Prevention, Behavior, Control and Cleanup of Oil Pollution, 5th, New Orleans, 1977. Jointly sponsored by the American Petroleum Institute, U.S. Environmental Protection Agency, and U.S. Coast Guard. The conference will feature 90 papers which stress training procedures, operational case histories, pollution prevention, and the development of new techniques for use in inland, coastal, deepwater, and arctic oil spill control operations.

FFI contact Dr. Charles C. Bates, Program Chairman-1977 Oil Spill Conference, U.S. Coast Guard (G-DS/62, TRANSPOINT), Washington, DC 20590.

Late March — UNEP Seminar, Paris, France, 1977. Sponsored by the United National Environmental Programme.

Subjects covered will include: blowout prevention; environmental impact; offshore development; environmental aspects of transportation by sea; crude oil pipelines; refinery effluents and emissions; health of refinery employees; oil in the marine environment and its force and effects. The objectives of the seminar are as follows:

1. To assess the state of the art of major aspects of the effects of the petroleum industry on the environment and of existing solutions to remedy recognized environmental hazards.
2. To assess the blank spots resulting from 1 above in order to identify the aspects for which no fully satisfactory solutions have been found or for which adequate data do not exist.
3. To identify scientific, technical and economic data needed by government bodies to make decisions on the protection of the environment.
4. To explore possible avenues for the solution of problems identified in 1, 2 and 3, and to discuss when and how they should be implemented, and by whom.
5. To outline avenues of research and development for the protection of the environment.

FFI contact United Nations Environmental Programme, Palais des Nations, CH-1211 Geneva 10, Switzerland.

Master List of Keywords

S: See
SA: See also

Absorption
Activated sludge
Adriatic Sea
Adsorption
Aegean Sea
Africa
Alaska
Alaska coast
Alaska, Gulf of
Algae ... SA: Phytoplankton
Analytical techniques ... SA: Chemical analysis; Source identification
Annelids
Antarctica
Arabian Sea
Arctic
Arctic Ocean
Argentina
Aromatic hydrocarons ... SA: Hydrocarbons, PAH
Asia
Atlantic coast
Atlantic Ocean
Australia
Bacteria
Bahamas
Ballast
Baltic Sea
Bantry Bay
Beaches
Beaufort Sea
Bengal, Bay of
Benthos
Bering Sea
Bibliographies
Bilges
Biodegradation
Biological effects ... SA: Toxicity
Biomass
Birds
Biscay, Bay of
Black Sea
Blowout prevention
Booms
Brazil
California
California coast
Canada
Carcinogens ... SA: Health hazards; Aromatic hydrocarbons; PAH
Caribbean Sea
Caspian Sea
Chedabucto Bay
Chemical analysis ... SA: Analytical techniques; Source identification
Chemical effects
Chesapeake Bay
Chile
China
Chromatography
Cleanup ... SA: Recovery; Containment
Coagulation
Coalescence
Coasts
Connecticut
Conservation
Containment
Contaminants
Contamination
Contingency planning
Crankcase oil
Crude oil
Crustaceans
Decomposition
Delaware
Delaware Bay
Denmark
Design and engineering
Detection ... SA: Monitoring; Chemical analysis
Dispersants
Dispersions
Disposal
Distillation
Drift ... SA: Movement; Spreading
Drilling ... SA: Offshore drilling; Oil wells
Economic effects
Economics
Ecosystems

Ecuador
Effluent treatment ... SA: Wastewater treatment
EIS
Emulsification
Emulsifiers
Emulsions
Engineering ... S: Design and engineering
England
English Channel
Entrainment
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Environmental effects
Environmental Impact Statements ... S: EIS
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Estuaries
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Evaporation
Exploration ... SA: Offshore exploration; Production
Extraction
Fate
Filtration ... SA: Flocculation
Finland
Fishes
Fisheries
Flocculation ... SA: Filtration
Florida
Florida coast
Food web
Foreign governments
Fossil fuels
France
Freshwater
Fuel oil
Fuels
Fungi
Gas, liquid chromatography ... S: Chromatography
Gasoline
Georgia
Germany, East
Germany, West
Gibraltar, Strait of
Government agencies ... SA: U.S. Government, State governments
Great Lakes
Groundwater
Guidelines ... SA: Manuals
Habitat
Harbors

Health hazards ... SA: Carcinogens
Hydrocarbons ... SA: Aromatic hydrocarbons, PAH, Crude oil
Incineration
India
Indian Ocean
Indonesia
Industries ... SA: Oil industry
Information systems
Infrared spectroscopy ... S: Spectroscopy
Inland
Insurance
International agreements
International conventions ... SA: Regulations; Legislation
Invertebrates
Iran
Iraq
Ireland
Israel
Italy
Japan
Japan, Sea of
Korea
Kuwait
Labrador Sea
Lakes ... SA: Great Lakes
Latin America
Law enforcement
Leakage
Legislation ... SA: Regulations; International conventions
Liability
Load-on-top
Louisiana
Lubricating oil
Magellan, Strait of
Maine
Manuals ... SA: Guidelines
Marine mammals
Marine organisms
Maryland
Massachusetts
Mass spectroscopy ... S: Spectroscopy
Mediterranean Sea
Metula Oil Spill
Mexico
Mexico, Gulf of

Microorganisms ... SA: Algae; Bacteria; Fungi; Yeasts
Middle East
Mississippi River
Models
Mollusks

Monitoring ... SA: Detection; Remote sensing; Sampling
Movement ... SA: Spreading; Drift
Natural seepage
Netherlands
Neuston
New Hampshire
New Jersey
New York
Niche
North Carolina
North Sea
North Vietnam
Norway
Norwegian Sea
Oceans
OCS
Offshore development ... SA: Offshore drilling, exploration, production
Offshore exploration ... SA: Offshore drilling, development
Offshore pipelines ... SA: Oil transport
Offshore production ... SA: Offshore development, drilling
Offshore drilling ... SA: Offshore development, exploration, production
Oil ... S: Crude oil; Fuel oil; Lubricating oil; Crankcase oil; Waste oil
Oil discharges
Oil fields ... SA: Production
Oil-gas leasing
Oil industry
Oil shale
Oil shale development
Oil slicks
Oil spills
Oil tanks ... SA: Storage
Oil transfer
Oil transport
Oil-water separation ... SA: Wastewater treatment
Oil wells ... SA: Drilling; Production; Offshore drilling; Offshore production
Okhotsk, Sea of
Oregon
Outer Continental Shelf ... S: OCS
Oxidation ... SA: Biodegradation; Weathering
Pacific Ocean
PAH ... SA: Aromatic hydrocarbons
Personnel training
Petroleum ... S: Crude oil
Petrochemicals
pH control
Philippines
Physical effects
Phytoplankton
Pipelines... SA: Offshore pipelines; Oil transport
Plankton ... SA: Phytoplankton; Zooplankton
Pollution prevention ... SA: Environmental protection; Contingency planning
Polyaromatic hydrocarbons ... S: PAH
Ports
Precipitation
Production ... SA: Offshore production; Drilling; Offshore drilling
Prudhoe Bay
Puerto Rico
Puget Sound
Reclamation ... SA: Recycling; Reuse
Recovery ... SA: Cleanup
Recycling ... SA: Reclamation; Reuse
Red Sea
Refineries
Refining
Regulations ... SA: Legislation; International conventions
Remote Sensing ... SA: Monitoring; Detection
Resource management
Restoration
Reuse ... SA: Reclamation; Recycling
Rhine River
Rhode Island
Rivers
Ross Sea
Sampling ... SA: Monitoring; Detection

San Francisco Bay
Santa Barbara Channel
Sargasso Sea
Saudi Arabia
Scotland
Seawater
Sedimentation
Sediments
Segregated Ballast
Ships
Shorelines
Sinking agents
Skimmers
Sludge
Social effects
Socio-economic effects
Soil
Solid waste
Solubility
Solution
Solvents
Source identification
South Carolina
Southern California
Spain
Spectrometry
Spectroscopy
Spreading ... SA: Movement; Drift
St. Lawrence River
Standing Crop
State governments ... SA: U.S. Government; Government agencies
Statistical analysis
Statistics
Storage ... SA: Oil tanks
Streams
Superports ... S: Ports
Supertankers ... S: Tankers
Surfactants
Sweden
Syria
Tankers
Tar
Tar sands
Texas
Torrey Canyon
Toxicity ... SA: Biological effects
Turkey
UK
United Kingdom ... S: UK
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US
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USSR
Venezuela
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Virginia
Wales
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Waste oil ... SA: Waste oil disposal, treatment
Waste oil disposal
Waste oil treatment
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Wastewater disposal
Wastewater treatment
Water quality
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Wildlife
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1894 ABSORPTION, CLEANUP, OIL SPILLS, *POLYSTYRENE BEADS,
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1818 BEACHES, SAMPLING, CONTAMINATION, *BAJA CALIFORNIA, FUELS,
1926 BEACHES, CLEANUP, SURFACTANTS, RESTORATION,
2130 BEACHES, BIOLOGICAL EFFECTS, OIL SPILLS, INVERTEBRATES, CHINA, RESTORATION, *MEIOFAUNA,
2141 BEACHES, BIOLOGICAL EFFECTS, OIL DISCHARGES, BALLAST, CLEANUP, RESTORATION, IRELAND,
1794 BEAUFORT SEA, MONITORING, HYDROCARBONS, TAR, SAMPLING,
1795 BEAUFORT SEA, MONITORING, TAR, NATURAL SEEPAGE, HYDROCARBONS, CHEMICAL ANALYSIS, *DISTRIBUTION,
2163 BEAUFORT SEA, OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS,
2181 BEAUFORT SEA, OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS,
2111 BENTHOS, OIL SPILLS, BIOLOGICAL EFFECTS, FRESHWATER, FISH, BIRDS, VIRGINIA,
2124 BENTHOS, OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, PHYTOPLANKTON, MICROORGANISMS, RESTORATION,
1835 BIBLIOGRAPHIES, CHEMICAL ANALYSIS, HYDROCARBONS, WASTEWATERS, WASTE OILS, CHROMATOGRAPHY,
2031 BIBLIOGRAPHIES, WASTEWATER TREATMENT, *PHENOLS, REFINERIES,
2123 BIBLIOGRAPHIES, BIOLOGICAL EFFECTS, CONTAMINATION, HEALTH HAZARDS, SOURCE IDENTIFICATION,
2155 BIBLIOGRAPHIES, OIL SHALE DEVELOPMENT, WILDLIFE, ENVIRONMENTAL EFFECTS, WATER

QUALITY,
2177 BIBLIOGRAPHIES, ENVIRONMENTAL MANAGEMENT, OCS, OFFSHORE-DEVELOPMENT, EIS,
2287 BIBLIOGRAPHIES, OIL SPILLS, BIOLOGICAL EFFECTS, CLEANUP, ABSORPTION,
2288 BIBLIOGRAPHIES, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, OIL SLICKS, *PETROLEUM OILS,
2289 BIBLIOGRAPHIES, ENVIRONMENTAL EFFECTS, TOXICITY, FRESHWATER, FISHES,
2290 BIBLIOGRAPHIES, BIOLOGICAL EFFECTS, CONTAMINATION, FRESHWATER, MARINE ORGANISMS,
1785 BILGES, MONITORING, SHIPS, DESIGN-ENGINEERING,
1947 BILGES, POLLUTION PREVENTION, TANKERS, SHIPS, OIL-WATER SEPARATION, BALLAST, *DUBAI DRY DOCK,
1973 BILGES, OIL-WATER SEPARATION, BALLAST, FILTRATION, COALESCENC DESIGN-ENGINEERING,
1976 BILGES, DISPERSIONS, OIL-WATER SEPARATION, COALESCENCE, BALLAST, TANKERS,
1958 BIODEGRADATION, WASTEWATER TREATMENT, FILTRATION,
2092 BIODEGRADATION, BIOLOGICAL EFFECTS, HYDROCARBONS, CRUSTACEANS, *UCA PUGNAX,
2193 BIODEGRADATION, OIL SPILLS, SEAWATER, EMULSIFIERS,
2194 BIODEGRADATION, CRUDE OIL, EMULSIFIERS, MICROORGANISMS,
2195 BIODEGRADATION, OIL SLICKS, CLEANUP, *NUTRIENT ADDITION,
2196 BIODEGRADATION, OIL SPILLS, MICROORGANISMS, FUNGI, BACTERIA,
2197 BIODEGRADATION, HYDROCARBONS, BACTERIA, OIL SPILLS, CLEANUP,
2198 BIODEGRADATION, BACTERIA, HYDROCARBONS, BIOLOGICAL EFFECTS, CHEMOTAXIS,
2199 BIODEGRADATION, SEAWATER, ANALYTICAL TECHNIQUES, *POLAROGRAPHIC RESPIROMETER,
2200 BIODEGRADATION, CRUDE OIL, ARCTIC, SOIL, FUNGI,
2201 BIODEGRADATION, HYDROCARBONS, BACTERIA, ATLANTIC COAST, SEDIMENTS, OIL SPILLS, CLEANUP,
2202 BIODEGRADATION, CRUDE OIL, BACTERIA, SEDIMENTS, ALASKA,
2203 BIODEGRADATION, OIL SPILLS, MICROORGANISMS, CRUDE OIL, *FERTILIZER,
2204 BIODEGRADATION, OIL SLICKS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, GREAT LAKES,
2205 BIODEGRADATION, SOIL, MONITORING, PLANTS,
2206 BIODEGRADATION, HYDROCARBONS, BACTERIA, *PSEUDOMONAS AERUGINOSA,
2207 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, ESTUARIES,
2208 BIODEGRADATION, CRUDE OIL, MICROORGANISMS,
2209 BIODEGRADATION, HYDROCARBONS, LAKES, MICROORGANISMS, CRUDE OIL,
2210 BIODEGRADATION, OIL SHALE, POLLUTION PREVENTION, OIL SHALE DEVELOPMENT, EXTRACTION,
2234 BIODEGRADATION, OIL SPILLS, HYDROCARBONS, SEDIMENTS, ESTUARIES, RHODE ISLAND,
2236 BIODEGRADATION, FATE, OIL SPILLS, INLAND, WEATHERING,
2241 BIODEGRADATION, OIL SPILLS, FATE, SPREADING, WEATHERING,
2244 BIODEGRADATION, FATE, HYDROCARBONS, MONITORING, DETECTION, TAR, PACIFIC OCEAN,
1751 BIOLOGICAL EFFECTS, BIRDS, OIL SPILLS, *MORTALITY,
1756 BIOLOGICAL EFFECTS, OIL SPILLS, ENGLISH CHANNEL, CLEANUP,
1781 BIOLOGICAL EFFECTS, MONITORING, BIOMASS, PLANKTON, OIL INDUSTRY, ENGLAND,
1783 BIOLOGICAL EFFECTS, MONITORING, HYDROCARBONS, FUEL OIL, MOLLUSKS, *MYTILUS EDULIS,
1829 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, OIL SPILLS, SAMPLING,
1837 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEAWATER, CANADA, MARINE ORGANISMS,
2085 BIOLOGICAL EFFECTS, MARINE MAMMALS, BIRDS, ARCTIC, ALASKA, *WALRUS,
2086 BIOLOGICAL EFFECTS, CRUDE OIL, FUEL OIL, MOLLUSKS, *OYSTERS, *OSMOREGULATION,
2088 BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, WASHINGTON, *ALPINE HABITAT,
2089 BIOLOGICAL EFFECTS, MARINE ORGANISMS, FUEL OIL, *PANAMA,
2090 BIOLOGICAL EFFECTS, HYDROCARBONS, MOLLUSKS, *HYDROCARBON METABOLISM, *MUSSELS,
2092 BIOLOGICAL EFFECTS, BIODEGRADATION, HYDROCARBONS, CRUSTACEANS, *UCA PUGNAX,
2093 BIOLOGICAL EFFECTS, BACTERIA, AROMATIC HYDROCARBONS , TOXICITY, MICROORGANISMS,
2096 BIOLOGICAL EFFECTS, OIL SPILLS, MARINE MAMMALS, WALES, *GREY SEALS,
2097 BIOLOGICAL EFFECTS, OIL SPILLS, NATURAL SEEPAGE, ARCTIC, PLANTS, RESTORATION, ALASKA,
2098 BIOLOGICAL EFFECTS, CRUDE OIL, CRUSTACEANS, *FECUNDITY, *COPEPOD,
2101 BIOLOGICAL EFFECTS, WASTE OIL, CRANKCASE OIL, SOIL, PLANTS,
2102 BIOLOGICAL EFFECTS, OIL SPILLS, PIPELINES, CANADA, PLANTS, PHYTOPLANKTON,
2103 BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, FUEL OIL, COASTS, CANADA,
2105 BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, CANADA, ARCTIC,
2106 BIOLOGICAL EFFECTS, OIL SPILLS, INFORMATION SYSTEMS, RESOURCE MANAGEMENT, WASHINGTON,
2107 BIOLOGICAL EFFECTS, BIOLOGICAL EFFECTS,CRUDE OIL, PHYTOPLANKTON, ALGAE, *PHOTOOXIDATION,
2108 BIOLOGICAL EFFECTS, CHEMICAL EFFECTS, CRUDE OIL, FISHES,
2109 BIOLOGICAL EFFECTS, CRUDE OIL, CRUSTACEANS, *AMPHIPOD,
2110 BIOLOGICAL EFFECTS, TOXICITY, DISPERSANTS, FISHES, INVERTEBRATES, *COREXIT 9527,
2111 BIOLOGICAL EFFECTS, OIL SPILLS, FRESHWATER, BENTHOS, FISH, BIRDS, VIRGINIA,
2112 BIOLOGICAL EFFECTS, TOXICITY, PETROCHEMICALS, FISHES,
2113 BIOLOGICAL EFFECTS, OIL SPILLS, ENVIRONMENTAL EFFECTS,
2114 BIOLOGICAL EFFECTS, CONTAMINANTS, PLANTS, OCEANS,
2115 BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ORGANISMS, UK,
2117 BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, CHEDABUCTO BAY, RESTORATION,
2118 BIOLOGICAL EFFECTS, BIRDS, SHORELINES, NORWAY, OFFSHORE-DRILLING, NORTH SEA,

2121 BIOLOGICAL EFFECTS, OIL SPILLS, HABITATS, NEW YORK,
2122 BIOLOGICAL EFFECTS, CRUDE OIL, MICROORGANISMS, SOIL, ARCTIC,
2123 BIOLOGICAL EFFECTS, CONTAMINATION, HEALTH HAZARDS, SOURCE IDENTIFICATION, BIBLIOGRAPHIES,
2124 BIOLOGICAL EFFECTS, OIL SPILLS, FRESHWATER, BENTHOS, PHYTOPLANKTON, MICROORGANISMS, RESTORATION,
2126 BIOLOGICAL EFFECTS, CRUDE OIL, AROMATIC HYDROCARBONS , BACTERIA,
2127 BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, FISHERIES, BIRDS, CLEANUP,
2128 BIOLOGICAL EFFECTS, DISPERSANTS, FISHES, *EMBRYONIC DEVELOPMENT,
2130 BIOLOGICAL EFFECTS, OIL SPILLS, BEACHES, INVERTEBRATES, CHINA, RESTORATION, *MEIOFAUNA,
2135 BIOLOGICAL EFFECTS, NORTH SEA, *POLLUTION,
2141 BIOLOGICAL EFFECTS, OIL DISCHARGES, BALLAST, BEACHES, CLEANUP, RESTORATION, IRELAND,
2142 BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, CANADA, ARCTIC, PHYSICAL EFFECTS, *THAW DEPTH,
2143 BIOLOGICAL EFFECTS, PAH, SEDIMENTS, MARINE ORGANISMS, BALTIC SEA, ANALYTICAL TECHNIQUES,
2153 BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PORTS, TANKERS, PACIFIC OCEAN,
2156 BIOLOGICAL EFFECTS, OCS, OFFSHORE EXPLORATION, ATLANTIC OCEAN, ZOOPLANKTON,
2157 BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, MARINE ORGANISMS, BIRDS,
2171 BIOLOGICAL EFFECTS, OFFSHORE-PRODUCTION, ENVIRONMENTAL PROTECTION, EUROPE, OIL TRANSPORT, OILSPILLS,
2181 BIOLOGICAL EFFECTS, OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS, BEAUFORT SEA,
2198 BIOLOGICAL EFFECTS, BIODEGRADATION, BACTERIA, HYDROCARBONS, CHEMOTAXIS,
2232 BIOLOGICAL EFFECTS, OIL SPILLS, DISPERSANTS, FATE, MISSISSIPPI RIVER,
2269 BIOLOGICAL EFFECTS, OFFSHORE-DRILLING, NORTH SEA, NORWAY, POLLUTION PREVENTION,
2287 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, CLEANUP, ABSORPTION,
2290 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, CONTAMINATION, FRESHWATER, MARINE ORGANISMS,
1751 BIRDS, OIL SPILLS, BIOLOGICAL EFFECTS, *MORTALITY,
2085 BIRDS, BIOLOGICAL EFFECTS, MARINE MAMMALS, ARCTIC, ALASKA, *WALRUS,
2111 BIRDS, OIL SPILLS, BIOLOGICAL EFFECTS, FRESHWATER, BENTHOS, FISH, VIRGINIA,
2118 BIRDS, SHORELINES, NORWAY, BIOLOGICAL EFFECTS, OFFSHORE-DRILLING, NORTH SEA,
2127 BIRDS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, FISHERIES, CLEANUP,
2157 BIRDS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, MARINE ORGANISMS,
1762 BLOWOUT PREVENTION, OIL WELLS, USSR, *NUCLEAR EXPLOSION,
2063 BLOWOUT PREVENTION, PERSONNEL TRAINING, DRILLING, OIL WELLS,
2064 BLOWOUT PREVENTION, PERSONNEL TRAINING, DRILLING, TEXAS,
2069 BLOWOUT PREVENTION, DRILLING, OFFSHORE DRILLING, DESIGN-ENGINEERING,
2071 BLOWOUT PREVENTION, OFFSHORE-DRILLING,
2075 BLOWOUT PREVENTION, OIL WELLS, DESIGN-ENGINEERING, DRILLING,
2079 BLOWOUT PREVENTION, OFFSHORE-DRILLING, DESIGN-ENGINEERING,
2080 BLOWOUT PREVENTION, OIL WELLS, POLLUTION PREVENTION, DESIGN-ENGINEERING,
2082 BLOWOUT PREVENTION, DESIGN-ENGINEERING, DRILLING,
2084 BLOWOUT PREVENTION, DESIGN-ENGINEERING, DRILLING,
2192 BLOWOUT PREVENTION, OFFSHORE-PRODUCTION, OFFSHORE-EXPLORATION, OIL SPILLS, CLEANUP, NORTH SEA,
1853 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1854 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1857 BOOMS, CONTAINMENT, OIL SPILLS, *CONNECTOR HINGE,
1861 BOOMS, CONTAINMENT, DESIGN-ENGINEERING,
1863 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1864 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1866 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1867 BOOMS, CONTAINMENT, OIL SLICKS, DESIGN-ENGINEERING,
1896 BOOMS, OIL SPILLS, WEATHERING, CLEANUP, SKIMMERS, ABSORPTION,
1898 BOOMS, MODELS, *OIL LOSSES,
2271 BRAZIL, LEGISLATION, OIL DISCHARGES, *PENALTIES,
1779 CALIFORNIA, MONITORING, CONTAMINATION, OCS, OFFSHORE DRILLING, SOUTHERN *BARIUM CONCENTRATIONS,
1818 CALIFORNIA, SAMPLING, CONTAMINATION, BEACHES, *BAJA FUELS,
2065 CALIFORNIA, CONTINGENCY PLANNING, OIL SPILLS, SOUTHERN OCS,
1806 CALIFORNIA COAST, REMOTE SENSING, DETECTION, OIL SPILLS, NATURAL SEEPAGE,
1752 CANADA, ENVIRONMENTAL PROTECTION, CONSERVATION, OIL INDUSTRY, *PACE,
1755 CANADA, ENVIRONMENTAL PROTECTION, ATLANTIC OCEAN, GOVERNMENT AGENCIES, *ENVIRONMENTAL PROTECTION SERVICE,
1837 CANADA, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEAWATER, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
1846 CANADA, SOURCE IDENTIFICATION, PAH, AROMATIC HYDROCARBONS , CARCINOGENS, CONTAMINATION,
1907 CANADA, GOVERNMENT AGENCIES, POLLUTION PREVENTION, CLEANUP, OIL SPILLS, EIS,
1922 CANADA, GOVERNMENT AGENCIES, CLEANUP, OIL SPILLS, GUIDELINES,

1942 CANADA, OIL SPILLS, PIPELINES, ENVIRONMENTAL EFFECTS, SOIL, RESTORATION,
1962 CANADA, WASTEWATER TREATMENT, REFINERIES, WATER QUALITY,
2067 CANADA, CONTINGENCY PLANNING, OIL SPILLS, OIL INDUSTRY, GUIDELINES
2078 CANADA, OIL SPILLS, GROUNDWATER, LEGISLATION, MANUALS, OIL INDUSTRY, POLLUTION PREVENTION,
2102 CANADA, BIOLOGICAL EFFECTS, OIL SPILLS, PIPELINES, PLANTS, PHYTOPLANKTON,
2103 CANADA, BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, FUEL OIL, COASTS,
2105 CANADA, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, ARCTIC,
2116 CANADA, TOXICITY, MARINE ORGANISMS, INVERTEBRATES, ARCTIC,
2140 CANADA, GROUNDWATER, CONTAMINATION, OIL SPILLS, STORAGE, PIPELINES, LEAKAGE,
2142 CANADA, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, ARCTIC, PHYSICAL EFFECTS, *THAW DEPTH,
2221 CANADA, RESTORATION, WEATHERING, SEDIMENTS, FATE, OIL SPILLS, CHEDABUCTO BAY,
2224 CANADA, OIL SLICKS, FATE, ESTUARIES, ST. LAWRENCE RIVER,
2238 CANADA, FATE, OIL SLICKS, MOVEMENT, REMOTE SENSING, *OIL-ICE INTERACTION,
2240 CANADA, MODELS, OIL SLICKS, MOVEMENT,
2272 CANADA, LEGISLATION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION,
2117 CHEDABUCTO BAY, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, RESTORATION,
2221 CHEDABUCTO BAY, RESTORATION, WEATHERING, SEDIMENTS, FATE, OIL SPILLS, CANADA,
2242 CHEDABUCTO BAY, OIL SPILLS, FATE, ATLANTIC OCEAN, MEDITERRANEAN SEA,
1795 CHEMICAL ANALYSIS, MONITORING, TAR, NATURAL SEEPAGE, HYDROCARBONS, BEAUFORT SEA, *DISTRIBUTION,
1796 CHEMICAL ANALYSIS, MONITORING, WASTE OIL, POLLUTION PREVENTION, NEW YORK, *BUFFALO RIVER,
1814 CHEMICAL ANALYSIS, SAMPLING, WASTEWATERS, REFINERIES,
1815 CHEMICAL ANALYSIS, SAMPLING, WASTEWATERS, REFINERIES,
1821 CHEMICAL ANALYSIS, CHROMATOGRAPHY, PAH, SAMPLING,
1823 CHEMICAL ANALYSIS, HYDROCARBONS, OCEANS, CHROMATOGRAPHY, SPECTROMETRY, SAMPLING,
1826 CHEMICAL ANALYSIS, PAH, WASTEWATERS, CHROMATOGRAPHY, *FLUORIMETRY,
1827 CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, HYDROCARBONS, FISHES,
1828 CHEMICAL ANALYSIS, OIL SPILLS, CHROMATOGRAPHY, SEDIMENTS, MAINE, *LONG COVE,
1830 CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, CRUDE OIL,
1832 CHEMICAL ANALYSIS, DETECTION, HYDROCARBONS, PAH, CHROMATOGRAPHY, CARCINOGENS,
1833 CHEMICAL ANALYSIS, PAH, CHROMATOGRAHPY, CARCINOGENS, *FRAGMENTOGRAPHY,
1834 CHEMICAL ANALYSIS, SAMPLING, COASTS, ITALY, OIL DISCHARGES, TANKERS,
1835 CHEMICAL ANALYSIS, HYDROCARBONS, WASTEWATERS, WASTE OILS, CHROMATOGRAPHY, BIBLIOGRAPHIES,
1838 CHEMICAL ANALYSIS, PAH, AROMATIC HYDROCARBONS , CARCINOGENS, *FLUORESCENCE,
1840 CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, SEDIMENTS, DELAWARE BAY, OIL SPILLS, SAMPLING,
1841 CHEMICAL ANALYSIS, HYDROCARBONS, SEDIMENTS, CHROMATOGRAPHY, JAPAN,
1842 CHEMICAL ANALYSIS, DETECTION, PAH, CHROMATOGRAPHY,
1843 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES,
1848 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CONTAMINATION, COASTS, INDIA,
1850 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CHROMATOGRAPHY, OIL SPILLS,
1851 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, OIL SPILLS, CHROMATOGRAPHY,
1975 CHEMICAL ANALYSIS, WASTEWATERS, REFINERIES, SAMPLING,
2204 CHEMICAL ANALYSIS, BIODEGRADATION, OIL SLICKS, CHROMATOGRAPHY, GREAT LAKES ,
2237 CHEMICAL ANALYSIS, WEATHERING, TAR, *FOULING ORGANISMS,
2239 CHEMICAL ANALYSIS, WEATHERING, CHROMATOGRAPHY, SPECTROSCOPY, ENVIRONMENTAL EFFECTS,
2288 CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCE IDENTIFICATION, OIL SLICKS, *PETROLEUM OILS,
2108 CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, CRUDE OIL, FISHES,
1743 CHESAPEAKE BAY, OIL SPILLS, FUEL OIL, REGULATIONS, US, *US COAST GUARD,
1748 CHESAPEAKE BAY, CLEANUP, OIL SPILLS, POLLUTION PREVENTION, *US COAST GUARD,
2012 CHILE, DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, REFINERIES,
2130 CHINA, BIOLOGICAL EFFECTS, OIL SPILLS, BEACHES, INVERTEBRATES, RESTORATION, *MEIOFAUNA,
1782 CHROMATOGRAPHY, MONITORING, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS, CARCINOGENS, PAH, *MUSSELS,
1821 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, SAMPLING,
1823 CHROMATOGRAPHY, HYDROCARBONS, OCEANS, CHEMICAL ANALYSIS, SPECTROMETRY, SAMPLING,
1824 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, DETECTION, PAH, SPECTROMETRY,
1826 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, WASTEWATERS, *FLUORIMETRY,
1827 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, HYDROCARBONS, FISHES,
1828 CHROMATOGRAPHY, OIL SPILLS, CHEMICAL ANALYSIS, SEDIMENTS, MAINE, *LONG COVE,
1830 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, CRUDE OIL,
1832 CHROMATOGRAPHY, DETECTION, HYDROCARBONS, PAH, CHEMICAL ANALYSIS, CARCINOGENS,
1835 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, WASTEWATERS, WASTE OILS, CHROMATOGRAPHY, BIBLIOGRAPHIES,
1840 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SEDIMENTS, DELAWARE BAY, OIL SPILLS, SAMPLING,
1841 CHROMATOGRAPHY, HYDROCARBONS, CHEMICAL ANALYSIS, SEDIMENTS, JAPAN,
1842 CHROMATOGRAPHY, DETECTION, PAH, CHEMICAL ANALYSIS,
1850 CHROMATOGRAPHY, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, OIL SPILLS,

1851 CHROMATOGRAPHY, SOURCE IDENTIFICATION, OIL SPILLS, CHEMICAL ANALYSIS,
2095 CHROMATOGRAPHY, TOXICITY, ANALYTICAL TECHNIQUES, FISHES, PLANKTON, ALGAE,
2204 CHROMATOGRAPHY, BIODEGRADATION, OIL SLICKS, CHEMICAL ANALYSIS, GREAT LAKES ,
2239 CHROMATOGRAPHY, WEATHERING, CHEMICAL ANALYSIS, SPECTROSCOPY, ENVIRONMENTAL EFFECTS,
1741 CLEANUP, OIL SPILLS, TANKERS, SPAIN, FISHERIES, BEACHES, *CORUNA OIL SPILL,
1742 CLEANUP, OIL SPILLS, FUEL OIL, RECOVERY, SKIMMERS, *GOWANUS CANAL,
1744 CLEANUP, INTERNATIONAL CONVENTIONS, GERMANY, WEST, OIL SPILLS, CONTAINMENT,
1748 CLEANUP, OIL SPILLS, POLLUTION PREVENTION, CHESAPEAKE BAY, *US COAST GUARD,
1756 CLEANUP, OIL SPILLS, ENGLISH CHANNEL, BIOLOGICAL EFFECTS,
1761 CLEANUP, OIL SPILLS, GROUNDWATER, SOURCE IDENTIFICATION,
1803 CLEANUP, REMOTE SENSING, OIL SPILLS, POLLUTION PREVENTION, *US COAST GUARD,
1811 CLEANUP, SAMPLING, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, OIL SPILLS, INDUSTRIES,
1859 CLEANUP, CONTAINMENT, OIL SLICKS, *OIL-COLLECTING AGENTS,
1862 CLEANUP, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1868 CLEANUP, OIL SPILLS, RECOVERY, SKIMMERS,
1869 CLEANUP, OIL SPILLS, ABSORPTION,
1870 CLEANUP, RECOVERY, OIL SPILLS, *SEA SLED,
1871 CLEANUP, RECOVERY, CONTAINMENT, HYDROCARBONS, OIL SPILLS,
1872 CLEANUP, OIL SPILLS, DESIGN-ENGINEERING, *DEBRIS HANDLING,
1875 CLEANUP, OIL SLICKS, WEATHERING, GERMANY, WEST, *PHOTOCHEMICAL DISSOLUTION,
1877 CLEANUP, OIL SLICKS, ESTUARIES, OIL-WATER SEPARATION, RECOVERY,
1878 CLEANUP, OIL SPILLS, MONITORING, MEDITERRANEAN SEA, PERSONNEL TRAINING,
1882 CLEANUP, OIL SPILLS, *ROTORK SEA TRUCK,
1884 CLEANUP, ABSORPTION, OIL SLICKS,
1885 CLEANUP, OIL SPILLS, DESIGN-ENGINEERING, SKIMMERS,
1887 CLEANUP, OIL SPILLS, COAGULATION,
1888 CLEANUP, OIL SPILLS, ADSORPTION,
1889 CLEANUP, OIL SPILLS, ADSORPTION,
1890 CLEANUP, CONTAINMENT, OIL SPILLS, SKIMMERS, *SORBENTS, *PISTON FILMS,
1892 CLEANUP, OIL SPILLS, CONTAINMENT, RECOVERY, OIL-WATER SEPARATION, DISPOSAL ,
1894 CLEANUP, OIL SPILLS, ABSORPTION, *POLYSTYRENE BEADS,
1896 CLEANUP, OIL SPILLS, WEATHERING, BOOMS, SKIMMERS, ABSORPTION,
1902 CLEANUP, RECOVERY, OIL SPILLS, *COMPUTER SIMULATION,
1903 CLEANUP, OIL SPILLS, CONTAMINATION, *WELL WATER,
1907 CLEANUP, GOVERNMENT AGENCIES, CANADA, POLLUTION PREVENTION, OIL SPILLS, EIS,
1908 CLEANUP, OIL SLICKS, SPREADING, RECOVERY, TOXICITY, *OIL HERDER,
1909 CLEANUP, OIL SPILLS, SINKING AGENTS,
1911 CLEANUP, OIL SPILLS, EMULSIONS, CRUDE OIL, FUEL OIL,
1912 CLEANUP, CRUDE OIL, OIL SLICKS, ECONOMICS, DECOMPOSITION, EVAPORATION, *LASER,
1913 CLEANUP, OIL SPILLS, DISPOSAL ,
1914 CLEANUP, OIL SPILLS, ADSORPTION,
1915 CLEANUP, CONTAINMENT, OIL SPILLS, *OIL HERDERS,
1918 CLEANUP, OIL SLICKS, RECOVERY, ADSORPTION,
1919 CLEANUP, RECOVERY, OIL SLICKS, ADSORPTION,
1921 CLEANUP, OIL SPILLS, RECOVERY, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1922 CLEANUP, GOVERNMENT AGENCIES, CANADA, OIL SPILLS, GUIDELINES,
1926 CLEANUP, BEACHES, SURFACTANTS, RESTORATION,
1929 CLEANUP, ADSORPTION, OIL SPILLS, DESIGN-ENGINEERING,
1931 CLEANUP, OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1933 CLEANUP, RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1934 CLEANUP, OIL SPILLS, ABSORPTION,
1936 CLEANUP, RESTORATION, SOIL, CONTAMINATION, OIL SPILLS,
1939 CLEANUP, OIL TRANSFER, TANKERS, ENGLAND, OIL SPILLS, POLLUTION PREVENTION,
1970 CLEANUP, WASTEWATER TREATMENT, SEDIMENTS, OIL INDUSTRY,
2062 CLEANUP, PERSONNEL TRAINING, OIL SPILLS,
2066 CLEANUP, CONTINGENCY PLANNING, OIL SPILLS, *COUNTER MEASURES,
2074 CLEANUP, ENVIRONMENTAL PROTECTION, INLAND, FRANCE, CONTAINMENT, OIL SPILLS,
2127 CLEANUP, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, FISHERIES, BIRDS,
2132 CLEANUP, ECONOMIC EFFECTS, OIL INDUSTRY, REGULATIONS, POLLUTION PREVENTION,
2133 CLEANUP, OIL SPILLS, TANKERS, ECONOMIC EFFECTS, DISPERSANTS, TOXICITY,
2141 CLEANUP, BIOLOGICAL EFFECTS, OIL DISCHARGES, BALLAST, BEACHES, RESTORATION, IRELAND,
2192 CLEANUP, OFFSHORE-PRODUCTION, OFFSHORE-EXPLORATION, OIL SPILLS, BLOWOUT PREVENTION, NORTH SEA,
2195 CLEANUP, BIODEGRADATION, OIL SLICKS, *NUTRIENT ADDITION,
2197 CLEANUP, BIODEGRADATION, HYDROCARBONS, BACTERIA, OIL SPILLS,
2201 CLEANUP, BIODEGRADATION, HYDROCARBONS, BACTERIA, ATLANTIC COAST, SEDIMENTS, OIL SPILLS,
2233 CLEANUP, OIL SPILLS, FATE, ARCTIC, WEATHERING, SOURCE IDENTIFICATION,
2247 CLEANUP, REGULATIONS, OIL SPILLS, OREGON,
2278 CLEANUP, INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, POLLUTION PREVENTION,
2283 CLEANUP, INTERNATIONAL CONVENTIONS, LIABIBLITY, OIL SPILLS,
2287 CLEANUP, BIBLIOGRAPHIES, OIL SPILLS, BIOLOGICAL EFFECTS, ABSORPTION,
1887 COAGULATION, OIL SPILLS, CLEANUP,

1990 COAGULATION, WASTEWATER TREATMENT, CRUDE OIL,
2006 COAGULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
2016 COAGULATION, REFINERIES, WASTEWATER TREATMENT, FILTRATION,
1959 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION,
1965 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, SKIMMERS,
1973 COALESCENCE, OIL-WATER SEPARATION, BILGE, BALLAST, FILTRATION, DESIGN-ENGINEERING,
1976 COALESCENCE, DISPERSIONS, OIL-WATER SEPARATION, BALLAST, BILGES, TANKERS,
1978 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1979 COALESCENCE, WASTEWATERS, OIL-WATER SEPARATION,
1981 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
1987 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
1999 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, ABSORPTION,
2006 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COAGULATION,
2018 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2212 COALESCENCE, CRUDE OIL, SPREADING, EMULSIFICATION, *FRESHWATER ICE CONDITIONS,
1766 COASTS, WASTEWATERS, OIL DISCHARGES, OCEANS, *MUNICIPAL & INDUSTRIAL INPUTS,
1773 COASTS, MONITORING, WALES, CONSERVATION, OFFSHORE DEVELOPMENT,
1804 COASTS, REMOTE SENSING, OIL SLICKS, MOVEMENT, ESTUARIES, DELAWARE BAY, *LANDSAT,
1834 COASTS, SAMPLING, CHEMICAL ANALYSIS, ITALY, OIL DISCHARGES, TANKERS,
1848 COASTS, SOURCE IDENTIFICATION, CONTAMINATION, CHEMICAL ANALYSIS, INDIA,
1858 COASTS, CONTAINMENT, RECOVERY, OIL SPILLS, SHORELINES,
2103 COASTS, BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, FUEL OIL, CANADA,
2159 COASTS, ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL MANAGEMENT,
2168 COASTS, ENVIRONMENTAL MANAGEMENT, LEGISLATION, GOVERNMENT AGENCIES, VIRGINIA, OFFSHORE-DEVELOPMENT,
1752 CONSERVATION, ENVIRONMENTAL PROTECTION, OIL INDUSTRY, CANADA, *PACE,
1773 CONSERVATION, MONITORING, COASTS, WALES, OFFSHORE DEVELOPMENT,
2050 CONSERVATION, RECLAMATION, REFINING, LUBRICATING OIL, WASTE OIL TREATMENT, ECONOMICS,
1744 CONTAINMENT, INTERNATIONAL CONVENTIONS, GERMANY, WEST, OIL SPILLS, CLEANUP,
1853 CONTAINMENT, OIL SPILLS, BOOMS, DESIGN-ENGINEERING,
1854 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING,
1855 CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1856 CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING, *MOORING DEVICE,
1857 CONTAINMENT, BOOMS, OIL SPILLS, *CONNECTOR HINGE,
1858 CONTAINMENT, RECOVERY, OIL SPILLS, COASTS, SHORELINES,
1859 CONTAINMENT, CLEANUP, OIL SLICKS, *OIL-COLLECTING AGENTS,
1860 CONTAINMENT, DESIGN-ENGINEERING, NEW YORK, *BUFFALO RIVER, *AIR BARRIER,
1861 CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1862 CONTAINMENT, OIL SPILLS, CLEANUP, DESIGN-ENGINEERING,
1863 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING,
1864 CONTAINMENT, OIL SPILLS, BOOMS, DESIGN-ENGINEERING,
1865 CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING, *BARRIER DELIVERY SYSTEM,
1866 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING,
1867 CONTAINMENT, OIL SLICKS, DESIGN-ENGINEERING, BOOMS,
1871 CONTAINMENT, RECOVERY, CLEANUP, HYDROCARBONS, OIL SPILLS,
1890 CONTAINMENT, CLEANUP, OIL SPILLS, SKIMMERS, *SORBENTS, *PISTON FILMS,
1892 CONTAINMENT, OIL SPILLS, CLEANUP, RECOVERY, OIL-WATER SEPARATION, DISPOSAL ,
1915 CONTAINMENT, CLEANUP, OIL SPILLS, *OIL HERDERS,
1916 CONTAINMENT, OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1932 CONTAINMENT, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1935 CONTAINMENT, MONITORING, SAMPLING, NEW YORK, *OIL POLLUTANTS, *BUFFALO RIVER,
1948 CONTAINMENT, OIL TRANSFER, TANKERS, OIL SPILLS,
2068 CONTAINMENT, POLLUTION PREVENTION, OIL SPILLS,
2074 CONTAINMENT, ENVIRONMENTAL PROTECTION, INLAND, FRANCE, CLEANUP, OIL SPILLS,
1831 CONTAMINANTS, ANALYTICAL TECHNIQUES, SAMPLING, OCEANS,
1897 CONTAMINANTS, DETECTION, RECOVERY, GROUNDWATER, DESIGN-ENGINEERING,
1982 CONTAMINANTS, WASTEWATER TREATMENT, HYDROCARBONS,
2114 CONTAMINANTS, BIOLOGICAL EFFECTS, PLANTS, OCEANS,
2146 CONTAMINANTS, HYDROCARBONS, ALASKA COAST, ENVIRONMENTAL EFFECTS,
2148 CONTAMINANTS, ENVIRONMENTAL EFFECTS, WASTEWATER TREATMENT,
2152 CONTAMINANTS, DRILLING, OIL WELLS, ENVIRONMENTAL EFFECTS, TOXICITY, GROUNDWATER,
1747 CONTAMINATION, GROUNDWATER, OIL TANKS, LEAKAGE, REGULATIONS, POLLUTION PREVENTION,
1779 CONTAMINATION, MONITORING, OCS, OFFSHORE DRILLING, SOUTHERN CALIFORNIA, *BARIUM CONCENTRATIONS,
1782 CONTAMINATION, MONITORING, MARINE ORGANISMS, SEDIMENTS, CARCINOGENS, PAH, CHROMATOGRAPHY, *MUSSELS,
1788 CONTAMINATION, MONITORING, RHINE RIVER, *MAAS RIVER, EUROPE,
1793 CONTAMINATION, MONITORING, DETECTION,
1818 CONTAMINATION, SAMPLING, BEACHES, *BAJA CALIFORNIA, FUELS,
1846 CONTAMINATION, SOURCE IDENTIFICATION, PAH, AROMATIC HYDROCARBONS , CARCINOGENS, CANADA,
1848 CONTAMINATION, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, COASTS, INDIA,
1903 CONTAMINATION, CLEANUP, OIL SPILLS, *WELL WATER,
1936 CONTAMINATION, RESTORATION, SOIL, OIL SPILLS, CLEANUP

1900 CONTAMINATION, GROUNDWATER, WASTEWATER DISPOSAL, OIL INDUSTRY, OKLAHOMA,
2123 CONTAMINATION, BIOLOGICAL EFFECTS, HEALTH HAZARDS, SOURCE IDENTIFICATION, BIBLIOGRAPHIES,
2140 CONTAMINATION, GROUNDWATER, OIL SPILLS, STORAGE, PIPELINES, LEAKAGE, CANADA,
2178 CONTAMINATION, ENVIRONMENTAL EFFECTS, PRODUCTION, OFFSHORE-DRILLING,
2229 CONTAMINATION, PAH, HYDROCARBONS, RIVERS, UK, *POTABLE WATER,
2290 CONTAMINATION, BIBLIOGRAPHIES, BIOLOGICAL EFFECTS, FRESHWATER, MARINE ORGANISMS,
2065 CONTINGENCY PLANNING, OIL SPILLS, SOUTHERN CALIFORNIA, OCS,
2066 CONTINGENCY PLANNING, OIL SPILLS, CLEANUP, *COUNTER MEASURES,
2067 CONTINGENCY PLANNING, OIL SPILLS, CANADA, OIL INDUSTRY, GUIDELINES
2169 CONTINGENCY PLANNING, REFINERIES, ENVIRONMENTAL PROTECTION, SCOTLAND, OIL SPILLS, MONITORING,
2249 CONTINGENCY PLANNING, LEGISLATION, US, OIL SPILLS, *CEQ,
2101 CRANKCASE OIL, BIOLOGICAL EFFECTS, WASTE OIL, SOIL, PLANTS,
1768 CRUDE OIL, OIL SPILLS, SHIPS, TANKERS, BEACHES, NEW YORK,
1830 CRUDE OIL, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS,
1904 CRUDE OIL, OIL SPILLS, RECOVERY, ARCTIC, FUEL OIL, *OPERATIONS TESTS,
1911 CRUDE OIL, OIL SPILLS, EMULSIONS, CLEANUP, FUEL OIL,
1912 CRUDE OIL, CLEANUP, OIL SLICKS, ECONOMICS, DECOMPOSITION, EVAPORATION, *LASER,
1923 CRUDE OIL, RECOVERY, *SUNKEN SHIPS, DESIGN-ENGINEERING,
1925 CRUDE OIL, OIL SPILLS, FUEL OIL, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1940 CRUDE OIL, STORAGE, REFINERIES, ENVIRONMENTAL EFFECTS, SCOTLAND, *UNDERGROUND STORAGE,
1952 CRUDE OIL, STORAGE, ECONOMICS, *UNDERGROUND STORAGE, *SURFACE TANKS,
1998 CRUDE OIL, WASTEWATER TREATMENT, COAGULATION,
2043 CRUDE OIL, EMULSIONS, *DEMULSIFICATION,
2086 CRUDE OIL, BIOLOGICAL EFFECTS, FUEL OIL, MOLLUSKS, *OYSTERS, *OSMOREGULATION,
2094 CRUDE OIL, TOXICITY, DISPERSANTS, *COREXIT 9527,
2098 CRUDE OIL, BIOLOGICAL EFFECTS, CRUSTACEANS, *FECUNDITY, *COPEPOD,
2100 CRUDE OIL, TOXICITY, FISHES, *TELEOSTS,
2103 CRUDE OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, FUEL OIL, COASTS, CANADA,
2104 CRUDE OIL, MICROORGANISMS, ARCTIC, MONITORING,
2107 CRUDE OIL, BIOLOGICAL EFFECTS,PHYTOPLANKTON, ALGAE, *PHOTOOXIDATION,
2108 CRUDE OIL, BIOLOGICAL EFFECTS, CHEMICAL EFFECTS, FISHES,
2109 CRUDE OIL, BIOLOGICAL EFFECTS, CRUSTACEANS, *AMPHIPOD,
2119 CRUDE OIL, TOXICITY, FUEL OIL, HYDROCARBONS, ANNELIDS, *POLYCHAETE WORMS,
2122 CRUDE OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, SOIL, ARCTIC,
2126 CRUDE OIL, AROMATIC HYDROCARBONS , BIOLOGICAL EFFECTS, BACTERIA,
2194 CRUDE OIL, BIODEGRADATION, EMULSIFIERS, MICROORGANISMS,
2200 CRUDE OIL, BIODEGRADATION, ARCTIC, SOIL, FUNGI,
2202 CRUDE OIL, BIODEGRADATION, BACTERIA, SEDIMENTS, ALASKA,
2203 CRUDE OIL, BIODEGRADATION, OIL SPILLS, MICROORGANISMS, *FERTILIZER,
2208 CRUDE OIL, BIODEGRADATION, MICROORGANISMS,
2209 CRUDE OIL, BIODEGRADATION, HYDROCARBONS, LAKES, MICROORGANISMS,
2212 CRUDE OIL, SPREADING, COALESCENCE, EMULSIFICATION, *FRESHWATER ICE CONDITIONS,
2215 CRUDE OIL, SOLUBILITY, HYDROCARBONS, FUEL OIL,
2220 CRUDE OIL, EMULSIFICATION, FUEL OIL, OIL SLICKS,
2225 CRUDE OIL, MONITORING, SEAWATER, SEDIMENTS, OIL TANKS, SPECTROSCOPY,
2092 CRUSTACEANS, BIODEGRADATION, BIOLOGICAL EFFECTS, HYDROCARBONS, *UCA PUGNAX,
2098 CRUSTACEANS, BIOLOGICAL EFFECTS, CRUDE OIL, *FECUNDITY, *COPEPOD,
2099 CRUSTACEANS, TOXICITY, FISHES, PETROCHEMICALS, OIL DISCHARGES,
2109 CRUSTACEANS, BIOLOGICAL EFFECTS, CRUDE OIL, *AMPHIPOD,
2125 CRUSTACEANS, TOXICITY, FUEL OIL, *SHRIMP,
1912 DECOMPOSITION, CLEANUP, CRUDE OIL, OIL SLICKS, ECONOMICS, EVAPORATION, *LASER,
2223 DECOMPOSITION, OIL TRANSFER, TOXICITY, FRESHWATER, SEAWATER,
2230 DELAWARE, OIL SPILLS, MOVEMENT, OFFSHORE-DEVELOPMENT, PORTS, NEW JERSEY,
1804 DELAWARE BAY, REMOTE SENSING, OIL SLICKS, MOVEMENT, COASTS, ESTUARIES, *LANDSAT,
1805 DELAWARE BAY, REMOTE SENSING, OIL SLICKS, MOVEMENT, *LANDSAT,
1840 DELAWARE BAY, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, SEDIMENTS, DELAWARE BAY, OIL SPILLS, SAMPLING,
1951 DELAWARE BAY, OIL TRANSPORT, SHIPS, REFINERIES, *SPORT FISHING,
2243 DELAWARE BAY, MODELS, OIL SPILLS, DRIFT, SPREADING,
1764 DETECTION, SOURCE IDENTIFICATION, OIL SPILLS, *RESEARCH SURVEY,
1774 DETECTION, MONITORING, REMOTE SENSING, *OIL POLLUTANTS, DESIGN-ENGINEERING, TOXICITY,
1778 DETECTION, MONITORING, WASTE OIL, ANALYTICAL TECHNIQUES, *SEWAGE,
1784 DETECTION, MONITORING, OIL SPILLS, HYDROCARBONS, DESIGN-ENGINEERING,
1786 DETECTION, MONITORING, *OIL-ON-WATER, *OIL-COLLECTION CHAMBER,
1791 DETECTION, MONITORING, DESIGN-ENGINEERING, *OIL DETECTOR,
1793 DETECTION, MONITORING, CONTAMINATION,
1797 DETECTION, REMOTE SENSING, OIL SPILLS, DESIGN-ENGINEERING, US COAST GUARD,
1801 DETECTION, REMOTE SENSING, SOURCE IDENTIFICATION, OIL SPILLS, *FLUORESCENCE,
1802 DETECTION, REMOTE SENSING, OIL SPILLS, MONITORING, REGULATIONS,
1806 DETECTION, REMOTE SENSING, OIL SPILLS, NATURAL SEEPAGE, CALIFORNIA COAST,
1824 DETECTION, ANALYTICAL TECHNIQUES, PAH, CHROMATOGRAPHY, SPECTROMETRY,

1832 DETECTION, HYDROCARBONS, PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CARCINOGENS,
1842 DETECTION, PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1897 DETECTION, RECOVERY, CONTAMINANTS, GROUNDWATER, DESIGN-ENGINEERING,
1927 DETECTION, DESIGN-ENGINEERING, RECOVERY, *OIL-WATER INTERFACE DETECTOR,
2244 DETECTION, FATE, HYDROCARBONS, MONITORING, TAR, BIODEGRADATION, PACIFIC OCEAN,
2094 DISPERSANTS, TOXICITY, CRUDE OIL, *COREXIT 9527,
2110 DISPERSANTS, BIOLOGICAL EFFECTS, TOXICITY, FISHES, INVERTEBRATES, *COREXIT 9527,
2120 DISPERSANTS, BIOLOGICAL EFFECTS, FISHES, *EMBRYONIC DEVELOPMENT,
2133 DISPERSANTS, OIL SPILLS, TANKERS, CLEANUP, ECONOMIC EFFECTS, TOXICITY,
2232 DISPERSANTS, OIL SPILLS, FATE, MISSISSIPPI RIVER, BIOLOGICAL EFFECTS,
1792 DISPERSIONS, MONITORING, WASTEWATERS, DESIGN-ENGINEERING,
1954 DISPERSIONS, OIL SPILLS, DRIFT, *SEA-SURFACE DRIFT CURRENTS,
1976 DISPERSIONS, OIL-WATER SEPARATION, COALESCENCE, BALLAST, BILGES, TANKERS,
2041 DISPERSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
1892 DISPOSAL , OIL SPILLS, CONTAINMENT, CLEANUP, RECOVERY, OIL-WATER SEPARATION,
1893 DISPOSAL , OIL SPILLS, MANUALS, GUIDELINES,
1913 DISPOSAL , OIL SPILLS, CLEANUP,
1986 DISPOSAL , *OILFIELD BRINES, *DEEP WELL INJECTION,
1994 DISPOSAL , WASTE OIL TREATMENT, RECOVERY, LEGISLATION, GERMANY, WEST,
2010 DISPOSAL , WASTE OIL, RECLAMATION, RECYCLING, WASTE OIL TREATMENT, REFINING,
2147 DISPOSAL , ENVIRONMENTAL EFFECTS, WASTEWATERS, OCEANS, *MARINE POLLUTION,
1954 DRIFT, OIL SPILLS, DISPERSIONS, *SEA-SURFACE DRIFT CURRENTS,
2243 DRIFT, MODELS, OIL SPILLS, SPREADING, DELAWARE BAY,
2036 DRILLING, WASTEWATER TREATMENT,
2063 DRILLING, PERSONNEL TRAINING, BLOWOUT PREVENTION, OIL WELLS,
2064 DRILLING, BLOWOUT PREVENTION, PERSONNEL TRAINING, TEXAS,
2075 DRILLING, BLOWOUT PREVENTION, OIL WELLS, DESIGN-ENGINEERING,
2082 DRILLING, BLOWOUT PREVENTION, DESIGN-ENGINEERING,
2084 DRILLING, BLOWOUT PREVENTION, DESIGN-ENGINEERING,
2152 DRILLING, OIL WELLS, CONTAMINANTS, ENVIRONMENTAL EFFECTS, TOXICITY, GROUNDWATER,
2166 DRILLING, OFFSHORE-PRODUCTION, DESIGN-ENGINEERING, ENVIRONMENTAL PROTECTION,
GUIDELINES,
2172 DRILLING, OIL WELLS, ENVIRONMENTAL EFFECTS, LEAKAGE, WASTEWATER DISPOSAL,
2132 ECONOMIC EFFECTS, OIL INDUSTRY, CLEANUP, REGULATIONS, POLLUTION PREVENTION,
2133 ECONOMIC EFFECTS, OIL SPILLS, TANKERS, CLEANUP, DISPERSANTS, TOXICITY,
2134 ECONOMIC EFFECTS, REGULATIONS, POLLUTION PREVENTION, GOVERNMENT AGENCIES,
2159 ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, OCS, COASTS, ENVIRONMENTAL MANAGEMENT,
2160 ECONOMIC EFFECTS, REFINERIES, REGULATIONS,
2184 ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, OCS, ALASKA, OFFSHORE-DEVELOPMENT,
*ONSHORE IMPACTS,
2187 ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE-PRODUCTION, FISHERIES,
NORTH SEA,
2250 ECONOMIC EFFECTS, LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS,
2261 ECONOMIC EFFECTS, LEGISLATION, US, PORTS, OIL TRANSFER, ENVIRONMENTAL EFFECTS,
1749 ECONOMICS, WASTE OIL, OIL DISCHARGES, US,
1912 ECONOMICS, CLEANUP, CRUDE OIL, OIL SLICKS, DECOMPOSITION, EVAPORATION, *LASER,
1943 ECONOMICS, POLLUTION PREVENTION, TANKERS, DESIGN-ENGINEERING, SEGREGATED BALLAST ,
LOAD-ON-TOP,
1952 ECONOMICS, STORAGE, CRUDE OIL, *UNDERGROUND STORAGE, *SURFACE TANKS,
1964 ECONOMICS, REFINERIES, WASTEWATER TREATMENT, ENVIRONMENTAL MANAGEMENT,
2037 ECONOMICS, OIL-WATER SEPARATION, SHIPS, US COAST GUARD,
2050 ECONOMICS, RECLAMATION, REFINING, LUBRICATING OIL, WASTE OIL TREATMENT,
CONSERVATION,
2258 ECONOMICS, LEGISLATION, US, ENVIRONMENTAL PROTECTION, OFFSHORE-PRODUCTION,
OIL TRANSPORT,
1807 ECOSYSTEMS, REMOTE SENSING, ESTUARIES, SHORELINES, *OIL POLLUTION,
2284 ECOSYSTEMS, INTERNATIONAL AGREEMENTS, WATER QUALITY, POLLUTION PREVENTION,
RHINE RIVER,
1907 EIS, GOVERNMENT AGENCIES, CANADA, POLLUTION PREVENTION, CLEANUP, OIL SPILLS,
2177 EIS, ENVIRONMENTAL MANAGEMENT, OCS, OFFSHORE-DEVELOPMENT, BIBLIOGRAPHIES,
2212 EMULSIFICATION, CRUDE OIL, SPREADING, COALESCENCE, *FRESHWATER ICE CONDITIONS,
2220 EMULSIFICATION, CRUDE OIL, FUEL OIL, OIL SLICKS,
2131 EMULSIFIERS, HYDROCARBONS, BACTERIA,
2193 EMULSIFIERS, BIODEGRADATION, OIL SPILLS, SEAWATER,
2194 EMULSIFIERS, BIODEGRADATION, CRUDE OIL, MICROORGANISMS,
1911 EMULSIONS, OIL SPILLS, CLEANUP, CRUDE OIL, FUEL OIL,
1960 EMULSIONS, WASTE OIL TREATMENT, OXIDATION, *DEMULSIFICATION,
1968 EMULSIONS, OIL-WATER SEPARATION, *SEPOL 443,
1981 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
1987 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
1995 EMULSIONS, OIL-WATER SEPARATION, ADSORPTION,
2001 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2009 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2013 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOCCULATION,
2015 EMULSIONS, OIL-WATER SEPARATION, OIL WELLS,

2022 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, ADSORPTION,
2030 EMULSIONS, WASTEWATER TREATMENT, FLOTATION,
2033 EMULSIONS, OIL-WATER SEPARATION, FILTRATION, *DRILLING FLUIDS,
2041 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, DISPERSIONS,
2042 EMULSIONS, OIL-WATER SEPARATION, *DEMULSIFICATION,
2043 EMULSIONS, CRUDE OIL, *DEMULSIFICATION,
2045 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOCCULATION,
2046 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES, PETROCHEMICALS,
1740 ENGLAND, OIL SPILLS, STATISTICS, LIABILITY, GOVERNMENT AGENCIES, *ACOPS,
1746 ENGLAND, POLLUTION PREVENTION, OIL SPILLS, LAW ENFORCEMENT, *ACOPS,
1781 ENGLAND, MONITORING, BIOLOGICAL EFFECTS, BIOMASS, PLANKTON, OIL INDUSTRY,
1820 ENGLAND, SAMPLING, HYDROCARBONS, PAH, ESTUARIES, *EPIPELIC DIATOMS,
1939 ENGLAND, OIL TRANSFER, TANKERS, OIL SPILLS, POLLUTION PREVENTION, CLEANUP,
2136 ENGLAND, REFINERIES, WASTEWATERS, OIL SPILLS, MONITORING, TOXICITY, *RESEARCH PROGRAM,
1756 ENGLISH CHANNEL, OIL SPILLS, CLEANUP, BIOLOGICAL EFFECTS,
1760 ENVIRONMENTAL EFFECTS, OIL SPILLS, TANKERS, METULA OIL SPILL, MAGELLAN/STRAIT OF,
1799 ENVIRONMENTAL EFFECTS, REMOTE SENSING, OIL SPILLS, MOVEMENT, OFFSHORE DEVELOPMENT, ALASKA COAST,
1940 ENVIRONMENTAL EFFECTS, STORAGE, CRUDE OIL, REFINERIES, SCOTLAND, *UNDERGROUND STORAGE,
1942 ENVIRONMENTAL EFFECTS, OIL SPILLS, PIPELINES, SOIL, RESTORATION, CANADA,
1946 ENVIRONMENTAL EFFECTS, PIPELINES, ALASKA, EXPLORATION, OIL TRANSPORT, *INDICATOR ORGANISMS, *ARCTIC FOX,
2113 ENVIRONMENTAL EFFECTS, OIL SPILLS, BIOLOGICAL EFFECTS,
2117 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, CHEDABUCTO BAY, RESTORATION,
2127 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, FISHERIES, BIRDS, CLEANUP,
2137 ENVIRONMENTAL EFFECTS, OIL DISCHARGES, OFFSHORE EXPLORATION,
2138 ENVIRONMENTAL EFFECTS, OIL SPILLS, OIL DISCHARGES, WASTEWATERS,
2139 ENVIRONMENTAL EFFECTS, HYDROCARBONS, FATE, MARINE ORGANISMS, POLLUTION PREVENTION,
2144 ENVIRONMENTAL EFFECTS, HYDROCARBONS, MEDITERRANEAN SEA,
2146 ENVIRONMENTAL EFFECTS, CONTAMINANTS, HYDROCARBONS, ALASKA COAST,
2140 ENVIRONMENTAL EFFECTS, CONTAMINANTS, WASTEWATER TREATMENT,
2147 ENVIRONMENTAL EFFECTS, DISPOSAL , WASTEWATERS, OCEANS, *MARINE POLLUTION,
2149 ENVIRONMENTAL EFFECTS, PAH, CARCINOGENS,
2152 ENVIRONMENTAL EFFECTS, DRILLING, OIL WELLS, CONTAMINANTS, TOXICITY, GROUNDWATER,
2153 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, PORTS, TANKERS, PACIFIC OCEAN,
2154 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, WILDLIFE, HABITATS,
2155 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, WILDLIFE, WATER QUALITY, BIBLIOGRAPHIES,
2157 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, MARINE ORGANISMS, BIRDS,
2158 ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, OCS, OFFSHORE DEVELOPMENT,
2162 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT,
2163 ENVIRONMENTAL EFFECTS, OFFSHORE-DRILLING, BEAUFORT SEA,
2167 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, INLAND,
2170 ENVIRONMENTAL EFFECTS, OFFSHORE-PRODUCTION, POLLUTION PREVENTION, REFINERIES, MONITORING,
2172 ENVIRONMENTAL EFFECTS, DRILLING, OIL WELLS, LEAKAGE, WASTEWATER DISPOSAL,
2174 ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT, *STATES RIGHTS,
2175 ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, OIL TRANSPORT, STORAGE,
2176 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, *PICEANCE BASIN,
2178 ENVIRONMENTAL EFFECTS, PRODUCTION, OFFSHORE-DRILLING, CONTAMINATION,
2179 ENVIRONMENTAL EFFECTS, SOCIAL EFFECTS, OIL SHALE DEVELOPMENT, *OIL POLLUTION,
2180 ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ATLANTIC COAST,
2181 ENVIRONMENTAL EFFECTS, OFFSHORE-DRILLING, BEAUFORT SEA, BIOLOGICAL EFFECTS,
2182 ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, *ERDA,
2183 ENVIRONMENTAL EFFECTS, OIL-GAS LEASING, ATLANTIC COAST, NEW JERSEY, *ONSHORE IMPACTS,
2184 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OCS, ALASKA, OFFSHORE-DEVELOPMENT, *ONSHORE IMPACTS,
2186 ENVIRONMENTAL EFFECTS, OIL TRANSPORT, ARCTIC, OFFSHORE-EXPLORATION, OFFSHORE-PRODUCTION, OIL INDUSTRY,
2187 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OFFSHORE-PRODUCTION, FISHERIES, NORTH SEA,
2188 ENVIRONMENTAL EFFECTS, OIL SPILLS, FATE, OFFSHORE-DEVELOPMENT, ATLANTIC OCEAN,
2189 ENVIRONMENTAL EFFECTS, OIL INDUSTRY, REFINING, OIL DISCHARGES, USSR,
2190 ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, *ENERGY DEVELOPMENT, *OIL POLLUTION,
2226 ENVIRONMENTAL EFFECTS, FATE, OIL SPILLS, BAHAMAS, OFFSHORE-DEVELOPMENT, PORTS,
2235 ENVIRONMENTAL EFFECTS, FATE, PAH, *SOURCES, *TRANSPORT,
2239 ENVIRONMENTAL EFFECTS, WEATHERING, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY,
2255 ENVIRONMENTAL EFFECTS, LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL

PROTECTION,
2256 ENVIRONMENTAL EFFECTS, LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL MANAGEMENT,
2261 ENVIRONMENTAL EFFECTS, LEGISLATION, US, PORTS, OIL TRANSFER, ECONOMIC EFFECTS,
2289 ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, FRESHWATER, FISHES,
1964 ENVIRONMENTAL MANAGEMENT, REFINERIES, WASTEWATER TREATMENT, ECONOMICS,
2159 ENVIRONMENTAL MANAGEMENT, ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, OCS, COASTS,
2168 ENVIRONMENTAL MANAGEMENT, COASTS, LEGISLATION, GOVERNMENT AGENCIES, VIRGINIA, OFFSHORE-DEVELOPMENT,
2177 ENVIRONMENTAL MANAGEMENT, OCS, OFFSHORE-DEVELOPMENT, EIS, BIBLIOGRAPHIES,
2256 ENVIRONMENTAL MANAGEMENT, LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL EFFECTS,
1752 ENVIRONMENTAL PROTECTION, CONSERVATION, OIL INDUSTRY, CANADA, *PACE,
1754 ENVIRONMENTAL PROTECTION, STATE GOVERNMENTS, ALASKA, OIL-GAS LEASING,
1755 ENVIRONMENTAL PROTECTION, CANADA, ATLANTIC OCEAN, GOVERNMENT AGENCIES, *ENVIRONMENTAL PROTECTION SERVICE,
1767 ENVIRONMENTAL PROTECTION, STATISTICAL ANALYSIS, GUIDELINES, *US COAST GUARD,
2074 ENVIRONMENTAL PROTECTION, INLAND, FRANCE, CONTAINMENT, CLEANUP, OIL SPILLS,
2151 ENVIRONMENTAL PROTECTION, OFFSHORE DEVELOPMENT, OIL SPILLS, GUIDELINES, SANTA BARBARA CHANNEL,
2166 ENVIRONMENTAL PROTECTION, DRILLING, OFFSHORE-PRODUCTION, DESIGN-ENGINEERING, GUIDELINES,
2169 ENVIRONMENTAL PROTECTION, REFINERIES, SCOTLAND, CONTINGENCY PLANNING, OIL SPILLS, MONITORING,
2171 ENVIRONMENTAL PROTECTION, OFFSHORE-PRODUCTION, EUROPE, OIL TRANSPORT, OIL SPILLS, BIOLOGICAL EFFECTS,
2255 ENVIRONMENTAL PROTECTION, LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL EFFECTS,
2258 ENVIRONMENTAL PROTECTION, LEGISLATION, US, OFFSHORE-PRODUCTION, OIL TRANSPORT, ECONOMICS,
2264 ENVIRONMENTAL PROTECTION, LEGISLATION, US, PRODUCTION, EXPLORATION, OIL INDUSTRY,
2270 ENVIRONMENTAL PROTECTION, REGULATIONS, OIL INDUSTRY, *NIGERIA,
2272 ENVIRONMENTAL PROTECTION, LEGISLATION, OIL INDUSTRY, CANADA,
2280 ENVIRONMENTAL PROTECTION, INTERNATIONAL CONVENTIONS, *OIL POLLUTION, *LAW OF THE SEA,
2286 ENVIRONMENTAL PROTECTION, OFFSHORE-DEVELOPMENT, GOVERNMENT AGENCIES, REGULATIONS,
1804 ESTUARIES, REMOTE SENSING, OIL SLICKS, MOVEMENT, COASTS, DELAWARE BAY, *LANDSAT,
1807 ESTUARIES, REMOTE SENSING, SHORELINES, ECOSYSTEMS, *OIL POLLUTION,
1820 ESTUARIES, SAMPLING, HYDROCARBONS, PAH, ENGLAND, *EPIPELIC DIATOMS,
1877 ESTUARIES, OIL SLICKS, OIL-WATER SEPARATION, CLEANUP, RECOVERY,
2083 ESTUARIES, POLLUTION PREVENTION, OIL-WATER SEPARATION, BALLAST, TANKERS, UK, NORTH SEA,
2207 ESTUARIES, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS,
2224 ESTUARIES, OIL SLICKS, FATE, CANADA, ST. LAWRENCE RIVER,
2234 ESTUARIES, OIL SPILLS, HYDROCARBONS, SEDIMENTS, RHODE ISLAND, BIODEGRADATION,
1788 EUROPE, MONITORING, RHINE RIVER, CONTAMINATION, *MAAS RIVER,
2035 EUROPE, WASTEWATER TREATMENT, REFINERIES, WATER QUALITY,
2171 EUROPE, OFFSHORE-PRODUCTION, ENVIRONMENTAL PROTECTION, OIL TRANSPORT, OIL SPILLS, BIOLOGICAL EFFECTS,
2275 EUROPE, INTERNATIONAL AGREEMENTS, OIL DISCHARGES, WASTEWATER DISPOSAL,
2277 EUROPE, INTERNATIONAL CONVENTIONS, LIABILITY, OIL SPILLS, ATLANTIC OCEAN,
1912 EVAPORATION, CLEANUP, CRUDE OIL, OIL SLICKS, ECONOMICS, DECOMPOSITION, *LASER,
1956 EVAPORATION, WASTEWATER TREATMENT, WASTE OIL,
2030 EVAPORATION, WASTEWATER TREATMENT, REFINERIES,
2214 EVAPORATION, *PETROLEUM PRODUCTS,
2217 EVAPORATION, HYDROCARBONS, OCEANS,
2219 EVAPORATION, OIL SLICKS, *EMPIRICAL FORMULAS,
1946 EXPLORATION, PIPELINES, ALASKA, ENVIRONMENTAL EFFECTS, OIL TRANSPORT, *INDICATOR ORGANISMS, *ARCTIC FOX,
2264 EXPLORATION, LEGISLATION, US, PRODUCTION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION,
2210 EXTRACTION, BIODEGRADATION, OIL SHALE, POLLUTION PREVENTION, OIL SHALE DEVELOPMENT,
1953 FATE, OIL TRANSFER, HYDROCARBONS, WEATHERING, PHYSICAL EFFECTS,
2139 FATE, HYDROCARBONS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, POLLUTION PREVENTION,
2188 FATE, OIL SPILLS, ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT, ATLANTIC OCEAN,
2221 FATE, RESTORATION, WEATHERING, SEDIMENTS, OIL SPILLS, CANADA, CHEDABUCTO BAY,
2224 FATE, OIL SLICKS, ESTUARIES, CANADA, ST. LAWRENCE RIVER,
2226 FATE, OIL SPILLS, BAHAMAS, ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT, PORTS,
2232 FATE, OIL SPILLS, DISPERSANTS, MISSISSIPPI RIVER, BIOLOGICAL EFFECTS,
2233 FATE, OIL SPILLS, ARCTIC, WEATHERING, CLEANUP, SOURCE IDENTIFICATION,
2235 FATE, PAH, ENVIRONMENTAL EFFECTS, *SOURCES, *TRANSPORT,
2236 FATE, OIL SPILLS, INLAND, BIODEGRADATION, WEATHERING,
2238 FATE, OIL SLICKS, MOVEMENT, REMOTE SENSING, CANADA, *OIL-ICE INTERACTION,
2241 FATE, OIL SPILLS, SPREADING, WEATHERING, BIODEGRADATION,
2242 FATE, OIL SPILLS, CHEDABUCTO BAY, ATLANTIC OCEAN, MEDITERRANEAN SEA,
2244 FATE, HYDROCARBONS, MONITORING, DETECTION, TAR, BIODEGRADATION, PACIFIC OCEAN,

1973 FILTRATION, BILGES, OIL-WATER SEPARATION, BALLAST, COALESCENCE, DESIGN-ENGINEERING,
1827 FISHES, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, HYDROCARBONS,
2095 FISHES, TOXICITY, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, PLANKTON, ALGAE,
2099 FISHES, TOXICITY, CRUSTACEANS, PETROCHEMICALS, OIL DISCHARGES,
2100 FISHES, TOXICITY, CRUDE OIL, *TELEOSTS,
2108 FISHES, BIOLOGICAL EFFECTS, CHEMICAL EFFECTS, CRUDE OIL,
2110 FISHES, BIOLOGICAL EFFECTS, TOXICITY, DISPERSANTS, INVERTEBRATES, *COREXIT 9527,
2112 FISHES, BIOLOGICAL EFFECTS, TOXICITY, PETROCHEMICALS,
2128 FISHES, BIOLOGICAL EFFECTS, DISPERSANTS, *EMBRYONIC DEVELOPMENT,
2289 FISHES, BIBLIOGRAPHIES, ENVIRONMENTAL EFFECTS, TOXICITY, FRESHWATER,
1741 FISHERIES, OIL SPILLS, TANKERS, SPAIN, BEACHES, CLEANUP, *CORUNA OIL SPILL,
2127 FISHERIES, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, BIRDS, CLEANUP,
2187 FISHERIES, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OFFSHORE-PRODUCTION, NORTH SEA,
1971 FLOCCULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2013 FLOCCULATION, WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION,
2021 FLOCCULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, ADSORPTION,
2028 FLOCCULATION, REFINERIES, WASTEWATER TREATMENT,
2034 FLOCCULATION, OIL-WATER SEPARATION, WASTEWATERS, TANKERS,
2045 FLOCCULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
2111 FRESHWATER, OIL SPILLS, BIOLOGICAL EFFECTS, BENTHOS, FISH, BIRDS, VIRGINIA,
2124 FRESHWATER, OIL SPILLS, BIOLOGICAL EFFECTS, BENTHOS, PHYTOPLANKTON, MICROORGANISMS, RESTORATION,
2223 FRESHWATER, OIL TRANSFER, DECOMPOSITION, TOXICITY, SEAWATER,
2289 FRESHWATER, BIBLIOGRAPHIES, ENVIRONMENTAL EFFECTS, TOXICITY, FISHES,
2290 FRESHWATER, BIBLIOGRAPHIES, BIOLOGICAL EFFECTS, CONTAMINATION, MARINE ORGANISMS,
1742 FUEL OIL, OIL SPILLS, CLEANUP, RECOVERY, SKIMMERS, *GOWANUS CANAL,
1743 FUEL OIL, OIL SPILLS, CHESAPEAKE BAY, REGULATIONS, US, *US COAST GUARD,
1780 FUEL OIL, MONITORING, WASTEWATERS, *FLUORESCENCE,
1783 FUEL OIL, MONITORING, HYDROCARBONS, BIOLOGICAL EFFECTS, MOLLUSKS, *MYTILUS EDULIS,
1839 FUEL OIL, ANALYTICAL TECHNIQUES, SPECTROSCOPY, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS,
1904 FUEL OIL, OIL SPILLS, RECOVERY, ARCTIC, CRUDE OIL, *OPERATIONS TESTS,
1911 FUEL OIL, OIL SPILLS, EMULSIONS, CLEANUP, CRUDE OIL,
1925 FUEL OIL, OIL SPILLS, CRUDE OIL, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1966 FUEL OIL, OIL-WATER SEPARATION, SLUDGE, SHIPS,
2086 FUEL OIL, BIOLOGICAL EFFECTS, CRUDE OIL, MOLLUSKS, *OYSTERS, *OSMOREGULATION,
2089 FUEL OIL, BIOLOGICAL EFFECTS, MARINE ORGANISMS, *PANAMA,
2103 FUEL OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, CRUDE OIL, COASTS, CANADA,
2119 FUEL OIL, TOXICITY, CRUDE OIL, HYDROCARBONS, ANNELIDS, *POLYCHAETE WORMS,
2125 FUEL OIL, TOXICITY, CRUSTACEANS, *SHRIMP,
2129 FUEL OIL, TOXICITY, MICROORGANISMS, ALGAE,
2215 FUEL OIL, SOLUBILITY, HYDROCARBONS, CRUDE OIL,
2220 FUEL OIL, EMULSIFICATION, CRUDE OIL, OIL SLICKS,
1818 FUELS, SAMPLING, CONTAMINATION, BEACHES, *BAJA CALIFORNIA,
2011 FUELS, WASTEWATER DISPOSAL, WASTE OIL, REUSE,
2049 FUELS, WASTE OIL, LUBRICATING OIL, REUSE,
2053 FUELS, WASTE OIL, LUBRICATING OIL, REUSE,
2196 FUNGI, BIODEGRADATION, OIL SPILLS, MICROORGANISMS, BACTERIA,
2200 FUNGI, BIODEGRADATION, CRUDE OIL, ARCTIC, SOIL,
1744 GERMANY, WEST, INTERNATIONAL CONVENTIONS, OIL SPILLS, CLEANUP, CONTAINMENT,
1798 GERMANY, WEST, REMOTE SENSING, OIL SPILLS, SPREADING,
1875 GERMANY, WEST, OIL SLICKS, CLEANUP, WEATHERING, *PHOTOCHEMICAL DISSOLUTION,
1994 GERMANY, WEST, WASTE OIL TREATMENT, RECOVERY, DISPOSAL , LEGISLATION,
1740 GOVERNMENT AGENCIES, OIL SPILLS, STATISTICS, LIABILITY, ENGLAND, *ACOPS,
1755 GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, CANADA, ATLANTIC OCEAN, *ENVIRONMENTAL PROTECTION SERVICE,
1907 GOVERNMENT AGENCIES, CANADA, POLLUTION PREVENTION, CLEANUP, OIL SPILLS, EIS,
1922 GOVERNMENT AGENCIES, CANADA, CLEANUP, OIL SPILLS, GUIDELINES,
2134 GOVERNMENT AGENCIES, ECONOMIC EFFECTS, REGULATIONS, POLLUTION PREVENTION,
2160 GOVERNMENT AGENCIES, ENVIRONMENTAL MANAGEMENT, COASTS, LEGISLATION, VIRGINIA, OFFSHORE-DEVELOPMENT,
2286 GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, OFFSHORE-DEVELOPMENT, REGULATIONS,
2204 GREAT LAKES , BIODEGRADATION, OIL SLICKS, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1747 GROUNDWATER, CONTAMINATION, OIL TANKS, LEAKAGE, REGULATIONS, POLLUTION PREVENTION,
1761 GROUNDWATER, OIL SPILLS, SOURCE IDENTIFICATION, CLEANUP,
1897 GROUNDWATER, DETECTION, RECOVERY, CONTAMINANTS, DESIGN-ENGINEERING,
1944 GROUNDWATER, PIPELINES, OIL TANKS, LEAKAGE, POLLUTION PREVENTION,
1988 GROUNDWATER, CONTAMINATION, WASTEWATER DISPOSAL, OIL INDUSTRY, OKLAHOMA,
2078 GROUNDWATER, OIL SPILLS, CANADA, LEGISLATION, MANUALS, OIL INDUSTRY, POLLUTION PREVENTION,
2081 GROUNDWATER, POLLUTION PREVENTION, PIPELINES, *CORROSION,
2140 GROUNDWATER, CONTAMINATION, OIL SPILLS, STORAGE, PIPELINES, LEAKAGE, CANADA,
2152 GROUNDWATER, DRILLING, OIL WELLS, CONTAMINANTS, ENVIRONMENTAL EFFECTS, TOXICITY,
1767 GUIDELINES, ENVIRONMENTAL PROTECTION, STATISTICAL ANALYSIS, *US COAST GUARD,
1893 GUIDELINES, OIL SPILLS, DISPOSAL , MANUALS,

1922 GUIDELINES, GOVERNMENT AGENCIES, CANADA, CLEANUP, OIL SPILLS,
1993 GUIDELINES, REFINERIES, WASTEWATER TREATMENT, ACTIVATED SLUDGE ,
2151 GUIDELINES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, OIL SPILLS, SANTA BARBARA CHANNEL,
2166 GUIDELINES, DRILLING, OFFSHORE-PRODUCTION, DESIGN-ENGINEERING, ENVIRONMENTAL PROTECTION,
2260 GUIDELINES, REGULATIONS, WASTEWATER TREATMENT, REFINERIES,
2285 GUIDELINES, OIL TRANSPORT, TANKERS,
2088 HABITAT, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, WASHINGTON, *ALPINE
2123 HEALTH HAZARDS, BIOLOGICAL EFFECTS, CONTAMINATION, SOURCE IDENTIFICATION, BIBLIOGRAPHIES,
2165 HEALTH HAZARDS, OIL INDUSTRY, OFFSHORE-PRODUCTION, NORTH SEA, *MEDICAL ASPECTS,
1757 HYDROCARBONS, OCEANS, *PETROLEUM HYDROCARBON EMISSION,
1783 HYDROCARBONS, MONITORING, FUEL OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *MYTILUS EDULIS,
1784 HYDROCARBONS, MONITORING, DETECTION, OIL SPILLS, DESIGN-ENGINEERING,
1794 HYDROCARBONS, MONITORING, TAR, BEAUFORT SEA, SAMPLING,
1795 HYDROCARBONS, MONITORING, TAR, NATURAL SEEPAGE, CHEMICAL ANALYSIS, BEAUFORT SEA, *DISTRIBUTION,
1820 HYDROCARBONS, SAMPLING, PAH, ESTUARIES, ENGLAND, *EPIPELIC DIATOMS,
1822 HYDROCARBONS, ANALYTICAL TECHNIQUES, SEAWATER, SEDIMENTS,
1823 HYDROCARBONS, OCEANS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, SAMPLING,
1827 HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, FISHES,
1830 HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CRUDE OIL,
1832 HYDROCARBONS, DETECTION, PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CARCINOGENS,
1835 HYDROCARBONS, CHEMICAL ANALYSIS, WASTEWATERS, WASTE OILS, CHROMATOGRAPHY, BIBLIOGRAPHIES,
1836 HYDROCARBONS, SEDIMENTS, MEDITERRANEAN SEA, ANALYTICAL TECHNIQUES, SPECTROMETRY,
1837 HYDROCARBONS, ANALYTICAL TECHNIQUES, SEAWATER, CANADA, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
1839 HYDROCARBONS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, FUEL OIL, MARINE ORGANISMS, SEDIMENTS,
1840 HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SEDIMENTS, DELAWARE BAY, OIL SPILLS, SAMPLING,
1841 HYDROCARBONS, CHEMICAL ANALYSIS, SEDIMENTS, CHROMATOGRAPHY, JAPAN,
1871 HYDROCARBONS, RECOVERY, CLEANUP, CONTAINMENT, OIL SPILLS,
1941 HYDROCARBONS, STORAGE, POLLUTION PREVENTION, REGULATIONS, *UNDERGROUND CAVERNS,
1953 HYDROCARBONS, OIL TRANSFER, FATE, WEATHERING, PHYSICAL EFFECTS,
1982 HYDROCARBONS, WASTEWATER TREATMENT, CONTAMINANTS,
2014 HYDROCARBONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *PARAFFINIC
2027 HYDROCARBONS, OIL-WATER SEPARATION, ABSORPTION,
2090 HYDROCARBONS, BIOLOGICAL EFFECTS, MOLLUSKS, *HYDROCARBON METABOLISM, *MUSSELS,
2091 HYDROCARBONS, TOXICITY, PLANTS, *ELECTROLYTE LOSS,
2092 HYDROCARBONS, BIODEGRADATION, BIOLOGICAL EFFECTS, CRUSTACEANS, *UCA PUGNAX,
2119 HYDROCARBONS, TOXICITY, FUEL OIL, CRUDE OIL, ANNELIDS, *POLYCHAETE WORMS,
2131 HYDROCARBONS, BACTERIA, EMULSIFIERS,
2139 HYDROCARBONS, ENVIRONMENTAL EFFECTS, FATE, MARINE ORGANISMS, POLLUTION PREVENTION,
2144 HYDROCARBONS, ENVIRONMENTAL EFFECTS, MEDITERRANEAN SEA,
2146 HYDROCARBONS, CONTAMINANTS, ALASKA COAST, ENVIRONMENTAL EFFECTS,
2197 HYDROCARBONS, BIODEGRADATION, BACTERIA, OIL SPILLS, CLEANUP,
2198 HYDROCARBONS, BIODEGRADATION, BACTERIA, BIOLOGICAL EFFECTS, CHEMOTAXIS,
2201 HYDROCARBONS, BIODEGRADATION, BACTERIA, ATLANTIC COAST, SEDIMENTS, OIL SPILLS, CLEANUP,
2206 HYDROCARBONS, BIODEGRADATION, BACTERIA, *PSEUDOMONAS AERUGINOSA,
2207 HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, ESTUARIES,
2209 HYDROCARBONS, BIODEGRADATION, LAKES, MICROORGANISMS, CRUDE OIL,
2213 HYDROCARBONS, SEAWATER, *VAPOR-LIQUID EQUILIBRIUM STUDIES,
2215 HYDROCARBONS, SOLUBILITY, FUEL OIL, CRUDE OIL,
2217 HYDROCARBONS, EVAPORATION, OCEANS,
2218 HYDROCARBONS, ARCTIC, SOIL, ADSORPTION,
2227 HYDROCARBONS, MONITORING, WASTEWATERS, INDUSTRIES, *BENZENE,
2229 HYDROCARBONS, PAH, CONTAMINATION, RIVERS, UK, *POTABLE WATER,
2234 HYDROCARBONS, OIL SPILLS, SEDIMENTS, ESTUARIES, RHODE ISLAND, BIODEGRADATION,
2244 HYDROCARBONS, FATE, MONITORING, DETECTION, TAR, BIODEGRADATION, PACIFIC OCEAN,
1992 INCINERATION, WASTE OIL DISPOSAL, PETROCHEMICALS,
2007 INCINERATION, WASTE OIL DISPOSAL, SLUDGE,
2008 INCINERATION, WASTE OIL DISPOSAL,
1848 INDIA, SOURCE IDENTIFICATION, CONTAMINATION, CHEMICAL ANALYSIS, COASTS,
1763 INDIAN OCEAN, OIL SPILLS, TOXICITY, REEFS,
1811 INDUSTRIES, SAMPLING, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, OIL SPILLS, CLEANUP,
1972 INDUSTRIES, WASTE OIL TREATMENT, FILTRATION,
1974 INDUSTRIES, POLLUTION PREVENTION, WASTEWATER TREATMENT, PETROCHEMICALS,
2005 INDUSTRIES, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2025 INDUSTRIES, WASTEWATER TREATMENT, WASTE OIL DISPOSAL,
2227 INDUSTRIES, MONITORING, HYDROCARBONS, WASTEWATERS, *BENZENE,

1750 INFORMATION SYSTEMS, OIL SPILLS,
2056 INFORMATION SYSTEMS, RECYCLING, WASTE OIL,
2106 INFORMATION SYSTEMS, BIOLOGICAL EFFECTS, OIL SPILLS, RESOURCE MANAGEMENT, WASHINGTON,
1886 INTERNATIONAL AGREEMENTS, POLLUTION PREVENTION, OIL SPILLS, RECOVERY, US, FRANCE,
2275 INTERNATIONAL AGREEMENTS, OIL DISCHARGES, WASTEWATER DISPOSAL, EUROPE,
2284 INTERNATIONAL AGREEMENTS, WATER QUALITY, POLLUTION PREVENTION, ECOSYSTEMS, RHINE RIVER,
1744 INTERNATIONAL CONVENTIONS, GERMANY, WEST, OIL SPILLS, CLEANUP, CONTAINMENT,
2150 INTERNATIONAL CONVENTIONS, LIABILITY, OIL SPILLS, LEGISLATION, US, *AQUATIC RESOURCES,
2266 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, SHIPS, TANKERS, LEGISLATION, *IMCO,
2267 INTERNATIONAL CONVENTIONS, LIABILITY, OIL TRANSPORT, SHIPS, *VESSEL-SOURCE POLLUTION,
2268 INTERNATIONAL CONVENTIONS, REGULATIONS, TANKERS, OIL TRANSPORT,
2273 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL TRANSPORT, TANKERS, SHIPS, OFFSHORE-DEVELOPMENT,
2274 INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, REGULATIONS, OIL DISCHARGES, SHIPS,
2276 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, US,
2277 INTERNATIONAL CONVENTIONS, LIABILITY, OIL SPILLS, ATLANTIC OCEAN, EUROPE,
2278 INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, POLLUTION PREVENTION, CLEANUP,
2279 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, LAW ENFORCEMENT,
2280 INTERNATIONAL CONVENTIONS, ENVIRONMENTAL PROTECTION, *OIL POLLUTION, *LAW OF THE SEA,
2281 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL SPILLS, OIL TRANSPORT, SHIPS,
2282 INTERNATIONAL CONVENTIONS, STATE GOVERNMENTS, POLLUTION PREVENTION, TANKERS, OIL SPILLS,
2283 INTERNATIONAL CONVENTIONS, LIABIBLITY, OIL SPILLS, CLEANUP,
2110 INVERTEBRATES, BIOLOGICAL EFFECTS, TOXICITY, DISPERSANTS, FISHES, *COREXIT 9527,
2116 INVERTEBRATES, TOXICITY, MARINE ORGANISMS, ARCTIC, CANADA,
2130 INVERTEBRATES, BIOLOGICAL EFFECTS, OIL SPILLS, BEACHES, CHINA, RESTORATION, *MEIOFAUNA,
2141 IRELAND, BIOLOGICAL EFFECTS, OIL DISCHARGES, BALLAST, BEACHES, CLEANUP, RESTORATION,
1834 ITALY, SAMPLING, CHEMICAL ANALYSIS, COASTS, OIL DISCHARGES, TANKERS,
1841 JAPAN, HYDROCARBONS, CHEMICAL ANALYSIS, SEDIMENTS, CHROMATOGRAPHY,
1989 JAPAN, WASTE OIL TREATMENT, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES,
2040 JAPAN, OIL INDUSTRY, PETROCHEMICALS, WASTEWATER TREATMENT,
2209 LAKES, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, CRUDE OIL,
1746 LAW ENFORCEMENT, POLLUTION PREVENTION, OIL SPILLS, ENGLAND, *ACOPS,
2279 LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION,
1747 LEAKAGE, CONTAMINATION, GROUNDWATER, OIL TANKS, REGULATIONS, POLLUTION PREVENTION,
1758 LEAKAGE, OIL TANKS, SWITZERLAND,
1770 LEAKAGE, OIL SPILLS, OCEANS, OFFSHORE PRODUCTION,
1937 LEAKAGE, OIL TRANSFER, TANKERS, OIL SPILLS, *SINGLE BUOY MOORING,
1944 LEAKAGE, PIPELINES, OIL TANKS, GROUNDWATER, POLLUTION PREVENTION,
2070 LEAKAGE, POLLUTION PREVENTION, OIL SPILLS, OIL TANKS,
2072 LEAKAGE, POLLUTION PREVENTION, OIL SPILLS, OIL TANKS,
2076 LEAKAGE, PIPELINES, POLLUTION PREVENTION, DESIGN-ENGINEERING,
2077 LEAKAGE, MANUALS, POLLUTION PREVENTION, OIL SPILLS, OIL DISCHARGES, LEGISLATION,
2140 LEAKAGE, GROUNDWATER, CONTAMINATION, OIL SPILLS, STORAGE, PIPELINES, CANADA,
2172 LEAKAGE, DRILLING, OIL WELLS, ENVIRONMENTAL EFFECTS, WASTEWATER DISPOSAL,
2222 LEAKAGE, *OIL LAYER, *FLOWING WATER,
1994 LEGISLATION, WASTE OIL TREATMENT, RECOVERY, DISPOSAL , GERMANY, WEST,
2054 LEGISLATION, WASTE OIL, RECYCLING, REUSE, LUBRICATING OIL, US,
2073 LEGISLATION, OIL SPILLS, INLAND, POLLUTION PREVENTION,
2077 LEGISLATION, MANUALS, POLLUTION PREVENTION, OIL SPILLS, LEAKAGE, OIL DISCHARGES,
2078 LEGISLATION, OIL SPILLS, GROUNDWATER, CANADA, MANUALS, OIL INDUSTRY, POLLUTION PREVENTION,
2150 LEGISLATION, LIABILITY, OIL SPILLS, INTERNATIONAL CONVENTIONS, US, *AQUATIC RESOURCES,
2168 LEGISLATION, ENVIRONMENTAL MANAGEMENT, COASTS, GOVERNMENT AGENCIES, VIRGINIA, OFFSHORE-DEVELOPMENT,
2249 LEGISLATION, US, CONTINGENCY PLANNING, OIL SPILLS, *CEQ,
2250 LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS, ECONOMIC EFFECTS,
2251 LEGISLATION, US, POLLUTION PREVENTION, *EPA,
2252 LEGISLATION, POLLUTION PREVENTION, OIL SPILLS, *NAVIGATION,
2253 LEGISLATION, OFFSHORE-EXPLORATION, OIL-GAS LEASING, *POLLUTION CONTROL,
2254 LEGISLATION, US, LIABILITY, OIL SPILLS, TANKERS, PORTS,
2255 LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS,
2256 LEGISLATION, OFFSHORE-EXPLORATION, OCS, ENVIRONMENTAL MANAGEMENT, ENVIRONMENTAL EFFECTS

2257 LEGISLATION, US, LIABILITY, OIL SPILLS,
2258 LEGISLATION, US, ENVIRONMENTAL PROTECTION, OFFSHORE-PRODUCTION, OIL TRANSPORT, ECONOMICS,
2259 LEGISLATION, US, POLLUTION PREVENTION, OFFSHORE-DRILLING, PORTS,
2261 LEGISLATION, US, PORTS, OIL TRANSFER, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
2262 LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS, LIABILITY, OIL SPILLS, TANKERS,
2264 LEGISLATION, US, PRODUCTION, EXPLORATION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION,
2265 LEGISLATION, WASTEWATER TREATMENT, OIL INDUSTRY,
2266 LEGISLATION, POLLUTION PREVENTION, SHIPS, TANKERS, INTERNATIONAL CONVENTIONS, *IMCO,
2271 LEGISLATION, BRAZIL, OIL DISCHARGES, *PENALTIES,
2272 LEGISLATION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION, CANADA,
2276 LEGISLATION, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION,US,
1740 LIABILITY, OIL SPILLS, STATISTICS, GOVERNMENT AGENCIES, ENGLAND, *ACOPS,
2150 LIABILITY, OIL SPILLS, INTERNATIONAL CONVENTIONS, LEGISLATION, US, *AQUATIC RESOURCES,
2246 LIABILITY, REGULATIONS, OIL SPILLS, OREGON,
2254 LIABILITY, LEGISLATION, US, OIL SPILLS, TANKERS, PORTS,
2257 LIABILITY, LEGISLATION, US, OIL SPILLS,
2262 LIABILITY, LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS, OIL SPILLS, TANKERS,
2263 LIABILITY, REGULATIONS, OIL DISCHARGES, *HAZARDOUS SUBSTANCES,
2267 LIABILITY, OIL TRANSPORT, SHIPS, INTERNATIONAL CONVENTIONS, *VESSEL-SOURCE POLLUTION,
2277 LIABILITY, INTERNATIONAL CONVENTIONS, OIL SPILLS, ATLANTIC OCEAN, EUROPE,
1943 LOAD-ON-TOP, POLLUTION PREVENTION, TANKERS, ECONOMICS, DESIGN-ENGINEERING, SEGREGATED BALLAST ,
2047 LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION,
2049 LUBRICATING OIL, WASTE OIL, REUSE, FUELS,
2050 LUBRICATING OIL, RECLAMATION, REFINING, WASTE OIL TREATMENT, CONSERVATION, ECONOMICS,
2051 LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION,
2053 LUBRICATING OIL, WASTE OIL, REUSE, FUELS,
2054 LUBRICATING OIL, WASTE OIL, RECYCLING, RFUSE, LEGISLATION, US,
2055 LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION,
2059 LUBRICATING OIL, RECLAMATION, RECYCLING, WASTE OIL,
2060 LUBRICATING OIL, RECLAMATION, REUSE, WASTE OIL,
1760 MAGELLAN/STRAIT OF, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, METULA OIL SPILL,
1828 MAINE, OIL SPILLS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SEDIMENTS, *LONG COVE,
1893 MANUALS, OIL SPILLS, DISPOSAL , GUIDELINES,
2077 MANUALS, POLLUTION PREVENTION, OIL SPILLS, LEAKAGE, OIL DISCHARGES, LEGISLATION,
2078 MANUALS, OIL SPILLS, GROUNDWATER, CANADA, LEGISLATION, OIL INDUSTRY, POLLUTION PREVENTION,
2085 MARINE MAMMALS, BIOLOGICAL EFFECTS, BIRDS, ARCTIC, ALASKA, *WALRUS,
2096 MARINE MAMMALS, BIOLOGICAL EFFECTS, OIL SPILLS, WALES, *GREY SEALS,
1782 MARINE ORGANISMS, MONITORING, CONTAMINATION, SEDIMENTS, CARCINOGENS, PAH, CHROMATOGRAPHY, *MUSSELS,
1816 MARINE ORGANISMS, SAMPLING, TAR, PACIFIC OCEAN,
1837 MARINE ORGANISMS, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEAWATER, CANADA, BIOLOGICAL EFFECTS,
1839 MARINE ORGANISMS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, FUEL OIL, HYDROCARBONS, SEDIMENTS,
2089 MARINE ORGANISMS, BIOLOGICAL EFFECTS, FUEL OIL, *PANAMA,
2115 MARINE ORGANISMS, BIOLOGICAL EFFECTS, OIL SPILLS, UK,
2116 MARINE ORGANISMS, TOXICITY, INVERTEBRATES, ARCTIC, CANADA,
2139 MARINE ORGANISMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, FATE, POLLUTION PREVENTION,
2143 MARINE ORGANISMS, BIOLOGICAL EFFECTS, PAH, SEDIMENTS, BALTIC SEA, ANALYTICAL TECHNIQUES,
2157 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, BIRDS,
2290 MARINE ORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES CONTAMINATION, FRESHWATER,
1812 MEDITERRANEAN SEA, SAMPLING, MONITORING, *OIL AGGREGATES, *DISTRIBUTION,
1817 MEDITERRANEAN SEA, SAMPLING, TAR, MONITORING,
1836 MEDITERRANEAN SEA, HYDROCARBONS, SEDIMENTS, ANALYTICAL TECHNIQUES, SPECTROMETRY,
1878 MEDITERRANEAN SEA, OIL SPILLS, CLEANUP, MONITORING, PERSONNEL TRAINING,
2061 MEDITERRANEAN SEA, POLLUTION PREVENTION, PERSONNEL TRAINING,
2144 MEDITERRANEAN SEA, HYDROCARBONS, ENVIRONMENTAL EFFECTS,
2242 MEDITERRANEAN SEA, OIL SPILLS, FATE, CHEDABUCTO BAY, ATLANTIC OCEAN,
2274 MEDITERRANEAN SEA, INTERNATIONAL CONVENTIONS, REGULATIONS, OIL DISCHARGES, SHIPS,
2278 MEDITERRANEAN SEA, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, CLEANUP,
1760 METULA OIL SPILL, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, MAGELLAN/STRAIT OF,
2231 MEXICO/GULF OF, OIL SPILLS, MOVEMENT, OFFSHORE-DEVELOPMENT, PORTS,
2093 MICROORGANISMS, BIOLOGICAL EFFECTS, BACTERIA, AROMATIC HYDROCARBONS , TOXICITY,
2103 MICROORGANISMS, BIOLOGICAL EFFECTS, CRUDE OIL, FUEL OIL, COASTS, CANADA,

2104 MICROORGANISMS, CRUDE OIL, ARCTIC, MONITORING,
2122 MICROORGANISMS, CRUDE OIL, BIOLOGICAL EFFECTS, SOIL, ARCTIC,
2124 MICROORGANISMS, OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, BENTHOS, PHYTOPLANKTON, RESTORATION,
2129 MICROORGANISMS, TOXICITY, FUEL OIL, ALGAE,
2194 MICROORGANISMS, BIODEGRADATION, CRUDE OIL, EMULSIFIERS,
2196 MICROORGANISMS, BIODEGRADATION, OIL SPILLS, FUNGI, BACTERIA,
2203 MICROORGANISMS, BIODEGRADATION, OIL SPILLS, CRUDE OIL, *FERTILIZER,
2207 MICROORGANISMS, BIODEGRADATION, HYDROCARBONS, ESTUARIES,
2208 MICROORGANISMS, BIODEGRADATION, CRUDE OIL,
2209 MICROORGANISMS, BIODEGRADATION, HYDROCARBONS, LAKES, CRUDE OIL,
2232 MISSISSIPPI RIVER, OIL SPILLS, DISPERSANTS, FATE, BIOLOGICAL EFFECTS,
1898 MODELS, BOOMS, *OIL LOSSES,
2185 MODELS, OFFSHORE-DEVELOPMENT, ALASKA COAST, *ONSHORE IMPACTS,
2240 MODELS, OIL SLICKS, MOVEMENT, CANADA,
2243 MODELS, OIL SPILLS, DRIFT, SPREADING, DELAWARE BAY,
1783 MOLLUSKS, MONITORING, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, *MYTILUS EDULIS,
2086 MOLLUSKS, BIOLOGICAL EFFECTS, CRUDE OIL, FUEL OIL, *OYSTERS, *OSMOREGULATION,
2090 MOLLUSKS, BIOLOGICAL EFFECTS, HYDROCARBONS, *HYDROCARBON METABOLISM, *MUSSELS,
1772 MONITORING, WASTEWATERS, REFINERIES, OIL TRANSFER, OFFSHORE DRILLING, OIL SPILLS, POLLUTION PREVENTION,
1773 MONITORING, COASTS, WALES, CONSERVATION, OFFSHORE DEVELOPMENT,
1774 MONITORING, DETECTION, REMOTE SENSING, *OIL POLLUTANTS, DESIGN-ENGINEERING, TOXICITY,
1775 MONITORING, OIL SLICKS, TAR, OCEANS, BEACHES,
1776 MONITORING, WASTEWATERS, *UV ABSORPTION,
1777 MONITORING, DESIGN-ENGINEERING, *OIL-IN-WATER MONITOR,
1778 MONITORING, DETECTION, WASTE OIL, ANALYTICAL TECHNIQUES, *SEWAGE,
1779 MONITORING, CONTAMINATION, OCS, OFFSHORE DRILLING, SOUTHERN CALIFORNIA, *BARIUM CONCENTRATIONS,
1780 MONITORING, WASTEWATERS, FUEL OIL, *FLUORESCENCE,
1781 MONITORING, BIOLOGICAL EFFECTS, BIOMASS, PLANKTON, OIL INDUSTRY, ENGLAND,
1782 MONITORING, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS, CARCINOGENS, PAH, CHROMATOGRAPHY, *MUSSELS,
1783 MONITORING, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *MYTILUS EDULIS,
1784 MONITORING, DETECTION, OIL SPILLS, HYDROCARBONS, DESIGN-ENGINEERING,
1785 MONITORING, BILGES, SHIPS, DESIGN-ENGINEERING,
1786 MONITORING, DETECTION, *OIL-ON-WATER, *OIL-COLLECTION CHAMBER,
1787 MONITORING, REMOTE SENSING, OIL SLICKS, MOVEMENT,
1788 MONITORING, RHINE RIVER, CONTAMINATION, *MAAS RIVER, EUROPE,
1789 MONITORING, WASTEWATERS, DESIGN-ENGINEERING, OIL-WATER SEPARATION,
1790 MONITORING, OIL DISCHARGES, WASTEWATERS, SAMPLING,
1791 MONITORING, DETECTION, DESIGN-ENGINEERING, *OIL DETECTOR,
1792 MONITORING, WASTEWATERS, DISPERSIONS, DESIGN-ENGINEERING,
1793 MONITORING, DETECTION, CONTAMINATION,
1794 MONITORING, HYDROCARBONS, TAR, BEAUFORT SEA, SAMPLING,
1795 MONITORING, TAR, NATURAL SEEPAGE, HYDROCARBONS, CHEMICAL ANALYSIS, BEAUFORT SEA, *DISTRIBUTION,
1796 MONITORING, WASTE OIL, CHEMICAL ANALYSIS, POLLUTION PREVENTION, NEW YORK, *BUFFALO RIVER,
1802 MONITORING, REMOTE SENSING, OIL SPILLS, DETECTION, REGULATIONS,
1808 MONITORING, REMOTE SENSING, OIL SPILLS, NATURAL SEEPAGE, *ERTS-1,
1809 MONITORING, REMOTE SENSING, OIL SLICKS, OIL SPILLS, ST. LAWRENCE RIVER, BAHAMAS,
1812 MONITORING, SAMPLING, MEDITERRANEAN SEA, *OIL AGGREGATES, *DISTRIBUTION,
1817 MONITORING, SAMPLING, TAR, MEDITERRANEAN SEA,
1878 MONITORING, OIL SPILLS, CLEANUP, MEDITERRANEAN SEA, PERSONNEL TRAINING,
1935 MONITORING, CONTAINMENT, SAMPLING, NEW YORK, *OIL POLLUTANTS, *BUFFALO RIVER,
2104 MONITORING, CRUDE OIL, MICROORGANISMS, ARCTIC,
2136 MONITORING, REFINERIES, WASTEWATERS, OIL SPILLS, TOXICITY, *RESEARCH PROGRAM, ENGLAND,
2169 MONITORING, REFINERIES, ENVIRONMENTAL PROTECTION, SCOTLAND, CONTINGENCY PLANNING, OIL SPILLS,
2170 MONITORING, ENVIRONMENTAL EFFECTS, OFFSHORE-PRODUCTION, POLLUTION PREVENTION, REFINERIES,
2205 MONITORING, BIODEGRADATION, SOIL, PLANTS,
2225 MONITORING, CRUDE OIL, SEAWATER, SEDIMENTS, OIL TANKS, SPECTROSCOPY,
2227 MONITORING, HYDROCARBONS, WASTEWATERS, INDUSTRIES, *BENZENE,
2244 MONITORING, FATE, HYDROCARBONS, DETECTION, TAR, BIODEGRADATION, PACIFIC OCEAN,
1787 MOVEMENT, MONITORING, REMOTE SENSING, OIL SLICKS,
1799 MOVEMENT, REMOTE SENSING, OIL SPILLS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA COAST,
1804 MOVEMENT, REMOTE SENSING, OIL SLICKS, COASTS, ESTUARIES, DELAWARE BAY, *LANDSAT,
1805 MOVEMENT, REMOTE SENSING, OIL SLICKS, DELAWARE BAY, *LANDSAT,
2230 MOVEMENT, OIL SPILLS, OFFSHORE-DEVELOPMENT, PORTS, NEW JERSEY, DELAWARE,
2231 MOVEMENT, OIL SPILLS, MEXICO/GULF OF, OFFSHORE-DEVELOPMENT, PORTS,

2238 MOVEMENT, FATE, OIL SLICKS, REMOTE SENSING, CANADA, *OIL-ICE INTERACTION,
2240 MOVEMENT, MODELS, OIL SLICKS, CANADA,
1745 NATURAL SEEPAGE, OCEANS, OFFSHORE PRODUCTION, *NOAA,
1769 NATURAL SEEPAGE, OCEANS,
1795 NATURAL SEEPAGE, MONITORING, TAR, HYDROCARBONS, CHEMICAL ANALYSIS, BEAUFORT SEA, *DISTRIBUTION,
1806 NATURAL SEEPAGE, REMOTE SENSING, DETECTION, OIL SPILLS, CALIFORNIA COAST,
1808 NATURAL SEEPAGE, REMOTE SENSING, OIL SPILLS, MONITORING, *ERTS-1,
1813 NATURAL SEEPAGE, SAMPLING, ALASKA, *ALASKA PENINSULA,
2097 NATURAL SEEPAGE, OIL SPILLS, ARCTIC, BIOLOGICAL EFFECTS, PLANTS, RESTORATION, ALASKA,
2183 NEW JERSEY, ENVIRONMENTAL EFFECTS, OIL-GAS LEASING, ATLANTIC COAST, *ONSHORE IMPACTS,
2230 NEW JERSEY, OIL SPILLS, MOVEMENT, OFFSHORE-DEVELOPMENT, PORTS, DELAWARE,
1768 NEW YORK, OIL SPILLS, SHIPS, TANKERS, BEACHES, CRUDE OIL,
1796 NEW YORK, MONITORING, WASTE OIL, CHEMICAL ANALYSIS, POLLUTION PREVENTION, NEW YORK, *BUFFALO RIVER,
1860 NEW YORK, CONTAINMENT, DESIGN-ENGINEERING, *BUFFALO RIVER, *AIR BARRIER,
1935 NEW YORK, CONTAINMENT, MONITORING, SAMPLING, *OIL POLLUTANTS, *BUFFALO RIVER,
2121 NEW YORK, BIOLOGICAL EFFECTS, OIL SPILLS, HABITATS,
1876 NORTH SEA, RECOVERY, OIL SPILLS, OFFSHORE-DRILLING,
2083 NORTH SEA, POLLUTION PREVENTION, OIL-WATER SEPARATION, BALLAST, TANKERS, ESTUARIES, UK,
2118 NORTH SEA, BIRDS, SHORELINES, NORWAY, BIOLOGICAL EFFECTS, OFFSHORE-DRILLING,
2135 NORTH SEA, BIOLOGICAL EFFECTS, *POLLUTION,
2165 NORTH SEA, OIL INDUSTRY, OFFSHORE-PRODUCTION, HEALTH HAZARDS, *MEDICAL ASPECTS,
2187 NORTH SEA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OFFSHORE-PRODUCTION, FISHERIES,
2192 NORTH SEA, OFFSHORE-PRODUCTION, OFFSHORE-EXPLORATION, OIL SPILLS, CLEANUP, BLOWOUT PREVENTION,
2269 NORTH SEA, OFFSHORE-DRILLING, BIOLOGICAL EFFECTS, NORWAY, POLLUTION PREVENTION,
1745 OCEANS, NATURAL SEEPAGE, OFFSHORE PRODUCTION, *NOAA,
1753 OCEANS, OIL DISCHARGES, SOURCE IDENTIFICATION, TANKERS, SHIPS,
1757 OCEANS, HYDROCARBONS, *PETROLEUM HYDROCARBON EMISSION,
1766 OCEANS, WASTEWATERS, OIL DISCHARGES, COASTS, *MUNICIPAL & INDUSTRIAL INPUTS,
1769 OCEANS, NATURAL SEEPAGE,
1770 OCEANS, OIL SPILLS, LEAKAGE, OFFSHORE PRODUCTION,
1775 OCEANS, MONITORING, OIL SLICKS, TAR, BEACHES,
1823 OCEANS, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, SAMPLING,
1831 OCEANS, ANALYTICAL TECHNIQUES, SAMPLING, CONTAMINANTS,
1847 OCEANS, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, TANKERS, SHIPS,
2114 OCEANS, BIOLOGICAL EFFECTS, CONTAMINANTS, PLANTS,
2147 OCEANS, ENVIRONMENTAL EFFECTS, DISPOSAL , WASTEWATERS, *MARINE POLLUTION,
2217 OCEANS, HYDROCARBONS, EVAPORATION,
1779 OCS, MONITORING, CONTAMINATION, OFFSHORE DRILLING, SOUTHERN CALIFORNIA, *BARIUM CONCENTRATIONS,
1949 OCS, STATISTICAL ANALYSIS, OIL TRANSPORT, PIPELINES, TANKERS, *ONSHORE TERMINAL,
2065 OCS, CONTINGENCY PLANNING, OIL SPILLS, SOUTHERN CALIFORNIA,
2156 OCS, BIOLOGICAL EFFECTS, OFFSHORE EXPLORATION, ATLANTIC OCEAN, ZOOPLANKTON,
2158 OCS, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
2159 OCS, ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, COASTS, ENVIRONMENTAL MANAGEMENT,
2161 OCS, OIL-GAS LEASING, ATLANTIC COAST, SOCIO-ECONOMIC EFFECTS, *ONSHORE IMPACTS,
2173 OCS, OFFSHORE-DEVELOPMENT, OIL SPILLS, ATLANTIC OCEAN, ALASKA/GULF OF, *NATURAL PHENOMENA,
2177 OCS, ENVIRONMENTAL MANAGEMENT, OFFSHORE-DEVELOPMENT, EIS, BIBLIOGRAPHIES,
2184 OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ALASKA, OFFSHORE-DEVELOPMENT, *ONSHORE IMPACTS,
2255 OCS, LEGISLATION, OFFSHORE-EXPLORATION, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS,
2256 OCS, LEGISLATION, OFFSHORE-EXPLORATION, ENVIRONMENTAL MANAGEMENT, ENVIRONMENTAL EFFECTS,
2164 OFFSHORE-DEVELOPMENT, ARCTIC, *PERMAFROST,
2168 OFFSHORE-DEVELOPMENT, ENVIRONMENTAL MANAGEMENT, COASTS, LEGISLATION, GOVERNMENT AGENCIES, VIRGINIA,
2173 OFFSHORE-DEVELOPMENT, OCS, OIL SPILLS, ATLANTIC OCEAN, ALASKA/GULF OF, *NATURAL PHENOMENA,
2174 OFFSHORE-DEVELOPMENT, ENVIRONMENTAL EFFECTS, *STATES RIGHTS,
2175 OFFSHORE-DEVELOPMENT, OFFSHORE-EXPLORATION, OIL TRANSPORT, STORAGE, ENVIRONMENTAL EFFECTS,
2177 OFFSHORE-DEVELOPMENT, ENVIRONMENTAL MANAGEMENT, OCS, EIS, BIBLIOGRAPHIES,
2180 OFFSHORE-DEVELOPMENT, OFFSHORE-EXPLORATION, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST,
2184 OFFSHORE-DEVELOPMENT, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OCS, ALASKA, *ONSHORE IMPACTS,
2185 OFFSHORE-DEVELOPMENT, MODELS, ALASKA COAST, *ONSHORE IMPACTS,

2180 OFFSHORE-DEVELOPMENT, OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN,
2226 OFFSHORE-DEVELOPMENT, FATE, OIL SPILLS, BAHAMAS, ENVIRONMENTAL EFFECTS, PORTS,
2230 OFFSHORE-DEVELOPMENT, OIL SPILLS, MOVEMENT, PORTS, NEW JERSEY, DELAWARE,
2231 OFFSHORE-DEVELOPMENT, OIL SPILLS, MOVEMENT, MEXICO/GULF OF, PORTS,
2250 OFFSHORE-DEVELOPMENT, LEGISLATION, PORTS, ECONOMIC EFFECTS,
2262 OFFSHORE-DEVELOPMENT, LEGISLATION, PORTS, LIABILITY, OIL SPILLS, TANKERS,
2273 OFFSHORE-DEVELOPMENT, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL TRANSPORT, TANKERS, SHIPS,
2286 OFFSHORE-DEVELOPMENT, ENVIRONMENTAL PROTECTION, GOVERNMENT AGENCIES, REGULATIONS,
1876 OFFSHORE-DRILLING, RECOVERY, OIL SPILLS, NORTH SEA,
2071 OFFSHORE-DRILLING, BLOWOUT PREVENTION,
2079 OFFSHORE-DRILLING, BLOWOUT PREVENTION, DESIGN-ENGINEERING,
2118 OFFSHORE-DRILLING, BIRDS, SHORELINES, NORWAY, BIOLOGICAL EFFECTS, NORTH SEA,
2163 OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS, BEAUFORT SEA,
2178 OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS, PRODUCTION, CONTAMINATION,
2181 OFFSHORE-DRILLING, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BIOLOGICAL EFFECTS,
2259 OFFSHORE-DRILLING, LEGISLATION, US, POLLUTION PREVENTION, PORTS,
2269 OFFSHORE-DRILLING, BIOLOGICAL EFFECTS, NORTH SEA, NORWAY, POLLUTION PREVENTION,
2175 OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, OIL TRANSPORT, STORAGE, ENVIRONMENTAL EFFECTS,
2180 OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST,
2186 OFFSHORE-EXPLORATION, OIL TRANSPORT, ARCTIC, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, OIL INDUSTRY,
2192 OFFSHORE-EXPLORATION, OFFSHORE-PRODUCTION, OIL SPILLS, CLEANUP, BLOWOUT PREVENTION, NORTH SEA,
2253 OFFSHORE-EXPLORATION, LEGISLATION, OIL-GAS LEASING, *POLLUTION CONTROL,
2255 OFFSHORE-EXPLORATION, LEGISLATION, OCS, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS,
2256 OFFSHORE-EXPLORATION, LEGISLATION, OCS, ENVIRONMENTAL MANAGEMENT, ENVIRONMENTAL EFFECTS,
2165 OFFSHORE-PRODUCTION, OIL INDUSTRY, HEALTH HAZARDS, NORTH SEA, *MEDICAL ASPECTS,
2166 OFFSHORE-PRODUCTION, DRILLING, DESIGN-ENGINEERING, ENVIRONMENTAL PROTECTION, GUIDELINES,
2170 OFFSHORE-PRODUCTION, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, REFINERIES, MONITORING,
2171 OFFSHORE-PRODUCTION, ENVIRONMENTAL PROTECTION, EUROPE, OIL TRANSPORT, OILSPILLS, BIOLOGICAL EFFECTS,
2186 OFFSHORE-PRODUCTION, OIL TRANSPORT, ARCTIC, ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OIL INDUSTRY,
2187 OFFSHORE-PRODUCTION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, FISHERIES, NORTH SEA,
2192 OFFSHORE-PRODUCTION, OFFSHORE-EXPLORATION, OIL SPILLS, CLEANUP, BLOWOUT PREVENTION, NORTH SEA,
2258 OFFSHORE-PRODUCTION, LEGISLATION, US, ENVIRONMENTAL PROTECTION, OIL TRANSPORT, ECONOMICS,
1749 OIL DISCHARGES, WASTE OIL, US, ECONOMICS,
1753 OIL DISCHARGES, OCEANS, SOURCE IDENTIFICATION, TANKERS, SHIPS,
1766 OIL DISCHARGES, WASTEWATERS, COASTS, OCEANS, *MUNICIPAL & INDUSTRIAL INPUTS,
1799 OIL DISCHARGES, MONITORING, WASTEWATERS, SAMPLING,
1834 OIL DISCHARGES, SAMPLING, CHEMICAL ANALYSIS, COASTS, ITALY, TANKERS,
1845 OIL DISCHARGES, SOURCE IDENTIFICATION, OIL SPILLS, TANKERS, OIL INDUSTRY,
1847 OIL DISCHARGES, SOURCE IDENTIFICATION, OIL SPILLS, OCEANS, TANKERS, SHIPS,
1950 OIL DISCHARGES, TANKERS, POLLUTION PREVENTION, SEGREGATED BALLAST ,
2077 OIL DISCHARGES, MANUALS, POLLUTION PREVENTION, OIL SPILLS, LEAKAGE, LEGISLATION,
2099 OIL DISCHARGES, TOXICITY, FISHES, CRUSTACEANS, PETROCHEMICALS,
2137 OIL DISCHARGES, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION,
2138 OIL DISCHARGES, OIL SPILLS, WASTEWATERS, ENVIRONMENTAL EFFECTS,
2141 OIL DISCHARGES, BIOLOGICAL EFFECTS, BALLAST, BEACHES, CLEANUP, RESTORATION, IRELAND,
2189 OIL DISCHARGES, OIL INDUSTRY, REFINING, ENVIRONMENTAL EFFECTS, USSR,
2245 OIL DISCHARGES, SOURCE IDENTIFICATION, TAR, PACIFIC OCEAN, TANKERS,
2248 OIL DISCHARGES, REGULATIONS, INLAND, ALASKA, *OILING PERMITS,
2263 OIL DISCHARGES, REGULATIONS, LIABILITY, *HAZARDOUS SUBSTANCES,
2271 OIL DISCHARGES, LEGISLATION, BRAZIL, *PENALTIES,
2274 OIL DISCHARGES, INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, REGULATIONS, SHIPS,
2275 OIL DISCHARGES, INTERNATIONAL AGREEMENTS, WASTEWATER DISPOSAL, EUROPE,
1754 OIL-GAS LEASING, STATE GOVERNMENTS, ALASKA, ENVIRONMENTAL PROTECTION,
2161 OIL-GAS LEASING, OCS, ATLANTIC COAST, SOCIO-ECONOMIC EFFECTS, *ONSHORE IMPACTS,
2183 OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, NEW JERSEY, *ONSHORE IMPACTS,
2253 OIL-GAS LEASING, LEGISLATION, OFFSHORE-EXPLORATION, *POLLUTION CONTROL,
1752 OIL INDUSTRY, ENVIRONMENTAL PROTECTION, CONSERVATION, CANADA, *PACE,
1781 OIL INDUSTRY, MONITORING, BIOLOGICAL EFFECTS, BIOMASS, PLANKTON, ENGLAND,
1845 OIL INDUSTRY, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, TANKERS,

1963 OIL INDUSTRY, WASTEWATER DISPOSAL, WASTE OIL,
1970 OIL INDUSTRY, WASTEWATER TREATMENT, SEDIMENTS, CLEANUP,
1980 OIL INDUSTRY, GROUNDWATER, CONTAMINATION, WASTEWATER DISPOSAL, OKLAHOMA,
1997 OIL INDUSTRY, WASTEWATERS, ANALYTICAL TECHNIQUES, REFINERIES, *HUNGARY,
2040 OIL INDUSTRY, PETROCHEMICALS, WASTEWATER TREATMENT, JAPAN,
2053 OIL INDUSTRY, RECLAMATION, WASTE OIL, *TESTING METHODS,
2067 OIL INDUSTRY, CONTINGENCY PLANNING, OIL SPILLS, CANADA, GUIDELINES
2078 OIL INDUSTRY, OIL SPILLS, GROUNDWATER, CANADA, LEGISLATION, MANUALS, POLLUTION PREVENTION,
2132 OIL INDUSTRY, ECONOMIC EFFECTS, CLEANUP, REGULATIONS, POLLUTION PREVENTION,
2165 OIL INDUSTRY, OFFSHORE-PRODUCTION, HEALTH HAZARDS, NORTH SEA, *MEDICAL ASPECTS,
2186 OIL INDUSTRY, OIL TRANSPORT, ARCTIC, ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-PRODUCTION,
2189 OIL INDUSTRY, REFINING, ENVIRONMENTAL EFFECTS, OIL DISCHARGES, USSR,
2191 OIL INDUSTRY, PRODUCTION, WATER QUALITY, *WATER RESOURCES,
2264 OIL INDUSTRY, LEGISLATION, US, PRODUCTION, EXPLORATION, ENVIRONMENTAL PROTECTION,
2265 OIL INDUSTRY, WASTEWATER TREATMENT, LEGISLATION,
2270 OIL INDUSTRY, REGULATIONS, ENVIRONMENTAL PROTECTION, *NIGERIA,
2272 OIL INDUSTRY, LEGISLATION, ENVIRONMENTAL PROTECTION, CANADA,
2210 OIL SHALE, BIODEGRADATION, POLLUTION PREVENTION, OIL SHALE DEVELOPMENT, EXTRACTION,
1775 OIL SLICKS, MONITORING, TAR, OCEANS, BEACHES,
1787 OIL SLICKS, MONITORING, REMOTE SENSING, MOVEMENT,
1804 OIL SLICKS, REMOTE SENSING, MOVEMENT, COASTS, ESTUARIES, DELAWARE BAY, *LANDSAT,
1805 OIL SLICKS, REMOTE SENSING, MOVEMENT, DELAWARE BAY, *LANDSAT,
1809 OIL SLICKS, REMOTE SENSING, OIL SPILLS, MONITORING, ST. LAWRENCE RIVER, BAHAMAS,
1859 OIL SLICKS, CONTAINMENT, CLEANUP, *OIL-COLLECTING AGENTS,
1867 OIL SLICKS, CONTAINMENT, DESIGN-ENGINEERING, BOOMS,
1875 OIL SLICKS, CLEANUP, WEATHERING, GERMANY, WEST, *PHOTOCHEMICAL DISSOLUTION,
1877 OIL SLICKS, ESTUARIES, OIL-WATER SEPARATION, CLEANUP, RECOVERY,
1884 OIL SLICKS, CLEANUP, ABSORPTION,
1908 OIL SLICKS, SPREADING, RECOVERY, CLEANUP, TOXICITY, *OIL HERDER,
1912 OIL SLICKS, CLEANUP, CRUDE OIL, ECONOMICS, DECOMPOSITION, EVAPORATION, *LASER,
1918 OIL SLICKS, CLEANUP, RECOVERY, ADSORPTION,
1919 OIL SLICKS, CLEANUP, RECOVERY, ADSORPTION,
2195 OIL SLICKS, BIODEGRADATION, CLEANUP, *NUTRIENT ADDITION,
2204 OIL SLICKS, BIODEGRADATION, CHEMICAL ANALYSIS, CHROMATOGRAPHY, GREAT LAKES ,
2219 OIL SLICKS, EVAPORATION, *EMPIRICAL FORMULAS,
2220 OIL SLICKS, EMULSIFICATION, CRUDE OIL, FUEL OIL,
2224 OIL SLICKS, FATE, ESTUARIES, CANADA, ST. LAWRENCE RIVER,
2238 OIL SLICKS, FATE, MOVEMENT, REMOTE SENSING, CANADA, *OIL-ICE INTERACTION,
2240 OIL SLICKS, MODELS, MOVEMENT, CANADA,
2288 OIL SLICKS, BIBLIOGRAPHIES, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *PETROLEUM OILS,
1740 OIL SPILLS, STATISTICS, LIABILITY, GOVERNMENT AGENCIES, ENGLAND, *ACOPS,
1741 OIL SPILLS, TANKERS, SPAIN, FISHERIES, BEACHES, CLEANUP, *CORUNA OIL SPILL,
1742 OIL SPILLS, FUEL OIL, CLEANUP, RECOVERY, SKIMMERS, *GOWANUS CANAL,
1743 OIL SPILLS, FUEL OIL, CHESAPEAKE BAY, REGULATIONS, US, *US COAST GUARD,
1744 OIL SPILLS, INTERNATIONAL CONVENTIONS, GERMANY, WEST, CLEANUP, CONTAINMENT,
1746 OIL SPILLS, POLLUTION PREVENTION, LAW ENFORCEMENT, ENGLAND, *ACOPS,
1748 OIL SPILLS, CLEANUP, POLLUTION PREVENTION, CHESAPEAKE BAY, *US COAST GUARD,
1750 OIL SPILLS, INFORMATION SYSTEMS,
1751 OIL SPILLS, BIRDS, BIOLOGICAL EFFECTS, *MORTALITY,
1756 OIL SPILLS, ENGLISH CHANNEL, CLEANUP, BIOLOGICAL EFFECTS,
1759 OIL SPILLS, *OIL LOSS, SWEDEN,
1760 OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, METULA OIL SPILL, MAGELLAN/STRAIT OF,
1761 OIL SPILLS, GROUNDWATER, SOURCE IDENTIFICATION, CLEANUP,
1763 OIL SPILLS, TOXICITY, REEFS, INDIAN OCEAN,
1764 OIL SPILLS, DETECTION, SOURCE IDENTIFICATION, *RESEARCH SURVEY,
1768 OIL SPILLS, SHIPS, TANKERS, BEACHES, CRUDE OIL, NEW YORK,
1770 OIL SPILLS, LEAKAGE, OCEANS, OFFSHORE PRODUCTION,
1771 OIL SPILLS, RESTORATION, *ALERT BAY OIL SPILL,
1784 OIL SPILLS, MONITORING, DETECTION, HYDROCARBONS, DESIGN-ENGINEERING,
1797 OIL SPILLS, REMOTE SENSING, DETECTION, DESIGN-ENGINEERING, US COAST GUARD,
1798 OIL SPILLS, REMOTE SENSING, SPREADING, GERMANY, WEST,
1799 OIL SPILLS, REMOTE SENSING, MOVEMENT, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA COAST,
1801 OIL SPILLS, REMOTE SENSING, DETECTION, SOURCE IDENTIFICATION, *FLUORESCENCE,
1802 OIL SPILLS, REMOTE SENSING, DETECTION, MONITORING, REGULATIONS,
1803 OIL SPILLS, REMOTE SENSING, POLLUTION PREVENTION, CLEANUP, *US COAST GUARD,
1806 OIL SPILLS, REMOTE SENSING, DETECTION, NATURAL SEEPAGE, CALIFORNIA COAST,
1808 OIL SPILLS, REMOTE SENSING, NATURAL SEEPAGE, MONITORING, *ERTS-1,
1809 OIL SPILLS, REMOTE SENSING, OIL SLICKS, MONITORING, ST. LAWRENCE RIVER, BAHAMAS,
1810 OIL SPILLS, SAMPLING, ADSORPTION,
1811 OIL SPILLS, SAMPLING, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, INDUSTRIES,

CLEANUP,
1828 OIL SPILLS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SEDIMENTS, MAINE, *LONG COVE,
1829 OIL SPILLS, ANALYTICAL TECHNIQUES, BIOLOGICAL EFFECTS, SAMPLING,
1840 OIL SPILLS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, SEDIMENTS, DELAWARE BAY, SAMPLING,
1843 OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS,
1844 OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, SPECTROSCOPY,
1845 OIL SPILLS, SOURCE IDENTIFICATION, OIL DISCHARGES, TANKERS, OIL INDUSTRY,
1847 OIL SPILLS, SOURCE IDENTIFICATION, OIL DISCHARGES, OCEANS, TANKERS, SHIPS,
1848 OIL SPILLS, SOURCE IDENTIFICATION, SAMPLING, ANALYTICAL TECHNIQUES, *US COAST GUARD,
1850 OIL SPILLS, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1851 OIL SPILLS, SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1853 OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1854 OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1855 OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING,
1856 OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING, *MOORING DEVICE,
1857 OIL SPILLS, CONTAINMENT, BOOMS, *CONNECTOR HINGE,
1858 OIL SPILLS, CONTAINMENT, RECOVERY, COASTS, SHORELINES,
1862 OIL SPILLS, CONTAINMENT, CLEANUP, DESIGN-ENGINEERING,
1863 OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1864 OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1865 OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING, *BARRIER DELIVERY SYSTEM,
1866 OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,
1868 OIL SPILLS, CLEANUP, RECOVERY, SKIMMERS,
1869 OIL SPILLS, CLEANUP, ABSORPTION,
1870 OIL SPILLS, CLEANUP, RECOVERY, *SEA SLED,
1871 OIL SPILLS, RECOVERY, CLEANUP, CONTAINMENT, HYDROCARBONS,
1872 OIL SPILLS, CLEANUP, DESIGN-ENGINEERING, *DEBRIS HANDLING,
1873 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1874 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1876 OIL SPILLS, RECOVERY, OFFSHORE-DRILLING, NORTH SEA,
1878 OIL SPILLS, CLEANUP, MONITORING, MEDITERRANEAN SEA, PERSONNEL TRAINING,
1879 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1880 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1881 OIL SPILLS, RECOVERY, ABSORPTION, DESIGN-ENGINEERING,
1882 OIL SPILLS, CLEANUP, *ROTORK SEA TRUCK,
1883 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1885 OIL SPILLS, CLEANUP, DESIGN-ENGINEERING, SKIMMERS,
1886 OIL SPILLS, POLLUTION PREVENTION, RECOVERY, INTERNATIONAL AGREEMENTS, US, FRANCE,
1887 OIL SPILLS, CLEANUP, COAGULATION,
1888 OIL SPILLS, CLEANUP, ADSORPTION,
1889 OIL SPILLS, CLEANUP, ADSORPTION,
1890 OIL SPILLS, CLEANUP, CONTAINMENT, SKIMMERS, *SORBENTS, *PISTON FILMS,
1891 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1892 OIL SPILLS, CONTAINMENT, CLEANUP, RECOVERY, OIL-WATER SEPARATION, DISPOSAL ,
1893 OIL SPILLS, DISPOSAL , MANUALS, GUIDELINES,
1894 OIL SPILLS, CLEANUP, ABSORPTION, *POLYSTYRENE BEADS,
1895 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1896 OIL SPILLS, WEATHERING, CLEANUP, BOOMS, SKIMMERS, ABSORPTION,
1899 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1900 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1901 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1902 OIL SPILLS, RECOVERY, CLEANUP, *COMPUTER SIMULATION,
1903 OIL SPILLS, CLEANUP, CONTAMINATION, *WELL WATER,
1904 OIL SPILLS, RECOVERY, ARCTIC, FUEL OIL, CRUDE OIL, *OPERATIONS TESTS,
1905 OIL SPILLS, POLLUTION PREVENTION, SHORELINES, ABSORPTION, DESIGN-ENGINEERING,
1906 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *SYSTEMS TESTS,
1907 OIL SPILLS, GOVERNMENT AGENCIES, CANADA, POLLUTION PREVENTION, CLEANUP, EIS,
1909 OIL SPILLS, CLEANUP, SINKING AGENTS,
1910 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1911 OIL SPILLS, EMULSIONS, CLEANUP, CRUDE OIL, FUEL OIL,
1913 OIL SPILLS, CLEANUP, DISPOSAL ,
1914 OIL SPILLS, CLEANUP, ADSORPTION,
1915 OIL SPILLS, CLEANUP, CONTAINMENT, *OIL HERDERS,
1916 OIL SPILLS, CONTAINMENT, RECOVERY, DESIGN-ENGINEERING,
1917 OIL SPILLS, ABSORPTION, WASTE OIL,
1920 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING, *SYSTEM ANALYSIS,
1921 OIL SPILLS, CLEANUP, RECOVERY, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1922 OIL SPILLS, GOVERNMENT AGENCIES, CANADA, CLEANUP, GUIDELINES,
1924 OIL SPILLS, RECOVERY, OIL-WATER SEPARATION, SHIPS, DESIGN-ENGINEERING,
1925 OIL SPILLS, CRUDE OIL, FUEL OIL, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1928 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1929 OIL SPILLS, CLEANUP, ADSORPTION, DESIGN-ENGINEERING,
1930 OIL SPILLS, RECOVERY, DESIGN-ENGINEERING, *OIL RESISTANT FABRIC,

1931 OIL SPILLS, CLEANUP, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1932 OIL SPILLS, RECOVERY, CONTAINMENT, DESIGN-ENGINEERING,
1933 OIL SPILLS, CLEANUP, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,
1934 OIL SPILLS, CLEANUP, ABSORPTION,
1936 OIL SPILLS, RESTORATION, SOIL, CONTAMINATION, CLEANUP,
1937 OIL SPILLS, OIL TRANSFER, TANKERS, LEAKAGE, *SINGLE BUOY MOORING,
1939 OIL SPILLS, OIL TRANSFER, TANKERS, ENGLAND, POLLUTION PREVENTION, CLEANUP,
1942 OIL SPILLS, PIPELINES, ENVIRONMENTAL EFFECTS, SOIL, RESTORATION, CANADA,
1940 OIL SPILLS, OIL TRANSFER, TANKERS, CONTAINMENT,
1954 OIL SPILLS, DRIFT, DISPERSIONS, *SEA-SURFACE DRIFT CURRENTS,
2062 OIL SPILLS, PERSONNEL TRAINING, CLEANUP,
2065 OIL SPILLS, CONTINGENCY PLANNING, SOUTHERN CALIFORNIA, OCS,
2066 OIL SPILLS, CONTINGENCY PLANNING, CLEANUP, *COUNTER MEASURES,
2067 OIL SPILLS, CONTINGENCY PLANNING, CANADA, OIL INDUSTRY, GUIDELINES
2068 OIL SPILLS, POLLUTION PREVENTION, CONTAINMENT,
2070 OIL SPILLS, POLLUTION PREVENTION, LEAKAGE, OIL TANKS,
2072 OIL SPILLS, POLLUTION PREVENTION, OIL TANKS, LEAKAGE,
2073 OIL SPILLS, INLAND, POLLUTION PREVENTION, LEGISLATION,
2074 OIL SPILLS, ENVIRONMENTAL PROTECTION, INLAND, FRANCE, CONTAINMENT, CLEANUP,
2077 OIL SPILLS, MANUALS, POLLUTION PREVENTION, LEAKAGE, OIL DISCHARGES, LEGISLATION,
2078 OIL SPILLS, GROUNDWATER, CANADA, LEGISLATION, MANUALS, OIL INDUSTRY, POLLUTION PREVENTION,
2088 OIL SPILLS, BIOLOGICAL EFFECTS, PLANTS, WASHINGTON, *ALPINE HABITAT,
2096 OIL SPILLS, BIOLOGICAL EFFECTS, MARINE MAMMALS, WALES, *GREY SEALS,
2097 OIL SPILLS, NATURAL SEEPAGE, ARCTIC, BIOLOGICAL EFFECTS, PLANTS, RESTORATION, ALASKA,
2102 OIL SPILLS, BIOLOGICAL EFFECTS, PIPELINES, CANADA, PLANTS, PHYTOPLANKTON,
2105 OIL SPILLS, BIOLOGICAL EFFECTS, PLANTS, CANADA, ARCTIC,
2106 OIL SPILLS, BIOLOGICAL EFFECTS, INFORMATION SYSTEMS, RESOURCE MANAGEMENT, WASHINGTON,
2111 OIL SPILLS, BIOLOGICAL EFFECTS, FRESHWATER, BENTHOS, FISH, BIRDS, VIRGINIA,
2113 OIL SPILLS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS,
2115 OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, UK,
2117 OIL SPILLS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, CHEDABUCTO BAY, RESTORATION,
2121 OIL SPILLS, BIOLOGICAL EFFECTS, HABITATS, NEW YORK,
2124 OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, BENTHOS, PHYTOPLANKTON, MICROORGANISMS, RESTORATION,
2127 OIL SPILLS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, FISHERIES, BIRDS, CLEANUP,
2130 OIL SPILLS, BIOLOGICAL EFFECTS, BEACHES, INVERTEBRATES, CHINA, RESTORATION, *MEIOFAUNA,
2133 OIL SPILLS, TANKERS, CLEANUP, ECONOMIC EFFECTS, DISPERSANTS, TOXICITY,
2136 OIL SPILLS, REFINERIES, WASTEWATERS, MONITORING, TOXICITY, *RESEARCH PROGRAM, ENGLAND,
2138 OIL SPILLS, OIL DISCHARGES, WASTEWATERS, ENVIRONMENTAL EFFECTS,
2140 OIL SPILLS, GROUNDWATER, CONTAMINATION, STORAGE, PIPELINES, LEAKAGE, CANADA,
2142 OIL SPILLS, BIOLOGICAL EFFECTS, PLANTS, CANADA, ARCTIC, PHYSICAL EFFECTS, *THAW DEPTH,
2150 OIL SPILLS, LIABILITY, INTERNATIONAL CONVENTIONS, LEGISLATION, US, *AQUATIC RESOURCES,
2151 OIL SPILLS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, GUIDELINES, SANTA BARBARA CHANNEL,
2157 OIL SPILLS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE ORGANISMS, BIRDS,
2173 OIL SPILLS, OFFSHORE-DEVELOPMENT, OCS, ATLANTIC OCEAN, ALASKA/GULF OF, *NATURAL PHENOMENA,
2188 OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT, ATLANTIC OCEAN,
2192 OIL SPILLS, OFFSHORE-PRODUCTION, OFFSHORE-EXPLORATION, CLEANUP, BLOWOUT PREVENTION, NORTH SEA,
2193 OIL SPILLS, BIODEGRADATION, SEAWATER, EMULSIFIERS,
2196 OIL SPILLS, BIODEGRADATION, MICROORGANISMS, FUNGI, BACTERIA,
2197 OIL SPILLS, BIODEGRADATION, HYDROCARBONS, BACTERIA, CLEANUP,
2201 OIL SPILLS, BIODEGRADATION, HYDROCARBONS, BACTERIA, ATLANTIC COAST, SEDIMENTS, CLEANUP,
2203 OIL SPILLS, BIODEGRADATION, MICROORGANISMS, CRUDE OIL, *FERTILIZER,
2216 OIL SPILLS, PHYSICAL EFFECTS, ARCTIC, SPREADING, *OIL UNDER ICE,
2221 OIL SPILLS, RESTORATION, WEATHERING, SEDIMENTS, FATE, CANADA, CHEDABUCTO BAY,
2226 OIL SPILLS, FATE, BAHAMAS, ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT, PORTS,
2230 OIL SPILLS, MOVEMENT, OFFSHORE-DEVELOPMENT, PORTS, NEW JERSEY, DELAWARE,
2231 OIL SPILLS, MOVEMENT, MEXICO/GULF OF, OFFSHORE-DEVELOPMENT, PORTS,
2232 OIL SPILLS, DISPERSANTS, FATE, MISSISSIPPI RIVER, BIOLOGICAL EFFECTS,
2233 OIL SPILLS, FATE, ARCTIC, WEATHERING, CLEANUP, SOURCE IDENTIFICATION,
2234 OIL SPILLS, HYDROCARBONS, SEDIMENTS, ESTUARIES, RHODE ISLAND, BIODEGRADATION,
2236 OIL SPILLS, FATE, INLAND, BIODEGRADATION, WEATHERING,
2241 OIL SPILLS, FATE, SPREADING, WEATHERING, BIODEGRADATION,

2242 OIL SPILLS, FATE, CHEDABUCTO BAY, ATLANTIC OCEAN, MEDITERRANEAN SEA,
2243 OIL SPILLS, MODELS, DRIFT, SPREADING, DELAWARE BAY,
2246 OIL SPILLS, REGULATIONS, LIABILITY, OREGON,
2247 OIL SPILLS, REGULATIONS, CLEANUP, OREGON,
2249 OIL SPILLS, LEGISLATION, US, CONTINGENCY PLANNING, *CEQ,
2252 OIL SPILLS, LEGISLATION, POLLUTION PREVENTION, *NAVIGATION,
2254 OIL SPILLS, LEGISLATION, US, LIABILITY, TANKERS, PORTS,
2257 OIL SPILLS, LEGISLATION, US, LIABILITY,
2262 OIL SPILLS, LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS, LIABILITY, TANKERS,
2276 OIL SPILLS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, LEGISLATION, US,
2277 OIL SPILLS, INTERNATIONAL CONVENTIONS, LIABILITY, ATLANTIC OCEAN, EUROPE,
2281 OIL SPILLS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL TRANSPORT, SHIPS,
2282 OIL SPILLS, INTERNATIONAL CONVENTIONS, STATE GOVERNMENTS, POLLUTION PREVENTION, TANKERS,
2283 OIL SPILLS, INTERNATIONAL CONVENTIONS, LIABIBLITY, CLEANUP,
2287 OIL SPILLS, BIBLIOGRAPHIES, BIOLOGICAL EFFECTS, CLEANUP, ABSORPTION,
1747 OIL TANKS, CONTAMINATION, GROUNDWATER, LEAKAGE, REGULATIONS, POLLUTION PREVENTION,
1758 OIL TANKS, LEAKAGE, SWITZERLAND,
1938 OIL TANKS, OIL-WATER SEPARATION, BALLAST, SHIPS, DESIGN-ENGINEERING,
1944 OIL TANKS, PIPELINES, LEAKAGE, GROUNDWATER, POLLUTION PREVENTION,
2070 OIL TANKS, POLLUTION PREVENTION, LEAKAGE, OIL SPILLS,
2072 OIL TANKS, POLLUTION PREVENTION, OIL SPILLS, LEAKAGE,
2225 OIL TANKS, MONITORING, CRUDE OIL, SEAWATER, SEDIMENTS, SPECTROSCOPY,
1772 OIL TRANSFER, MONITORING, WASTEWATERS, REFINERIES, OFFSHORE DRILLING, OIL SPILLS, POLLUTION PREVENTION,
1937 OIL TRANSFER, TANKERS, OIL SPILLS, LEAKAGE, *SINGLE BUOY MOORING,
1939 OIL TRANSFER, TANKERS, ENGLAND, OIL SPILLS, POLLUTION PREVENTION, CLEANUP,
1948 OIL TRANSFER, TANKERS, CONTAINMENT, OIL SPILLS,
1953 OIL TRANSFER, FATE, HYDROCARBONS, WEATHERING, PHYSICAL EFFECTS,
2223 OIL TRANSFER, DECOMPOSITION, TOXICITY, FRESHWATER, SEAWATER,
2261 OIL TRANSFER, LEGISLATION, US, PORTS, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
1945 OIL TRANSPORT, PETROCHEMICALS, REGULATIONS,
1946 OIL TRANSPORT, PIPELINES, ALASKA, ENVIRONMENTAL EFFECTS, EXPLORATION, *INDICATOR ORGANISMS, *ARCTIC FOX,
1949 OIL TRANSPORT, STATISTICAL ANALYSIS, PIPELINES, TANKERS, OCS, *ONSHORE TERMINAL,
1951 OIL TRANSPORT, SHIPS, REFINERIES, DELAWARE BAY, *SPORT FISHING,
2171 OIL TRANSPORT, OFFSHORE-PRODUCTION, ENVIRONMENTAL PROTECTION, EUROPE, OIL SPILLS, BIOLOGICAL EFFECTS,
2175 OIL TRANSPORT, OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, STORAGE, ENVIRONMENTAL EFFECTS,
2186 OIL TRANSPORT, ARCTIC, ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-PRODUCTION, OIL INDUSTRY,
2258 OIL TRANSPORT, LEGISLATION, US, ENVIRONMENTAL PROTECTION, OFFSHORE-PRODUCTION, ECONOMICS,
2267 OIL TRANSPORT, LIABILITY, SHIPS, INTERNATIONAL CONVENTIONS, *VESSEL-SOURCE POLLUTION,
2268 OIL TRANSPORT, REGULATIONS, TANKERS, INTERNATIONAL CONVENTIONS,
2273 OIL TRANSPORT, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, TANKERS, SHIPS, OFFSHORE-DEVELOPMENT,
2281 OIL TRANSPORT, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL SPILLS, SHIPS,
2285 OIL TRANSPORT, GUIDELINES, TANKERS,
1789 OIL-WATER SEPARATION, MONITORING, WASTEWATERS, DESIGN-ENGINEERING,
1877 OIL-WATER SEPARATION, OIL SLICKS, ESTUARIES, CLEANUP, RECOVERY,
1892 OIL-WATER SEPARATION, OIL SPILLS, CONTAINMENT, CLEANUP, RECOVERY, DISPOSAL ,
1921 OIL-WATER SEPARATION, OIL SPILLS,.CLEANUP, RECOVERY, DESIGN-ENGINEERING,
1924 OIL-WATER SEPARATION, OIL SPILLS, RECOVERY, SHIPS, DESIGN-ENGINEERING,
1938 OIL-WATER SEPARATION, BALLAST, SHIPS, OIL TANKS, DESIGN-ENGINEERING,
1947 OIL-WATER SEPARATION, POLLUTION PREVENTION, TANKERS, SHIPS, BILGES, BALLAST, *DUBAI DRY DOCK,
1959 OIL-WATER SEPARATION, WASTEWATER TREATMENT, FILTRATION, COALESCENCE,
1961 OIL-WATER SEPARATION, WASTE OIL TREATMENT, SLUDGE,
1965 OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE, SKIMMERS,
1966 OIL-WATER SEPARATION, FUEL OIL, SLUDGE, SHIPS,
1967 OIL-WATER SEPARATION, WASTEWATER TREATMENT, SLUDGE,
1968 OIL-WATER SEPARATION, EMULSIONS, *SEPOL 443,
1969 OIL-WATER SEPARATION, WASTEWATER TREATMENT, DESIGN-ENGINEERING, SHIPS, REFINERIES,
1971 OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOCCULATION,
1973 OIL-WATER SEPARATION, BILGE, BALLAST, FILTRATION, COALESCENCE, DESIGN-ENGINEERING,
1976 OIL-WATER SEPARATION, DISPERSIONS, COALESCENCE, BALLAST, BILGES, TANKERS,
1977 OIL-WATER SEPARATION, WASTEWATER TREATMENT, RECLAMATION,
1978 OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE,
1979 OIL-WATER SEPARATION, WASTEWATERS, COALESCENCE,
1980 OIL-WATER SEPARATION, WASTEWATER TREATMENT, BALLAST, TANKERS,
1981 OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE, EMULSIONS,
1983 OIL-WATER SEPARATION, WASTE OIL DISPOSAL, DESIGN-ENGINEERING, WASTEWATER TREATMENT

1984 OIL-WATER SEPARATION, WASTEWATER TREATMENT, FILTRATION,
1987 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, COALESCENCE,
1989 OIL-WATER SEPARATION, WASTE OIL TREATMENT, WASTEWATER TREATMENT, REFINERIES, JAPAN
1991 OIL-WATER SEPARATION, WASTEWATERS, SHIPS, DESIGN-ENGINEERING,
1995 OIL-WATER SEPARATION, EMULSIONS, ADSORPTION,
1999 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION, COALESCENCE,
2000 OIL-WATER SEPARATION, WASTEWATER TREATMENT,
2001 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS,
2005 OIL-WATER SEPARATION, WASTEWATER TREATMENT, INDUSTRIES,
2006 OIL-WATER SEPARATION, WASTEWATER TREATMENT, COAGULATION, COALESCENCE,
2009 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS,
2012 OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATERS, REFINERIES, CHILE,
2013 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, FLOCCULATION,
2014 OIL-WATER SEPARATION, WASTEWATER TREATMENT, *PARAFFINIC HYDROCARBONS,
2015 OIL-WATER SEPARATION, EMULSIONS, OIL WELLS,
2018 OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE,
2019 OIL-WATER SEPARATION, WASTEWATER TREATMENT, REFINERIES, FILTRATION,
2021 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ADSORPTION FLOCCULATION,
2022 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, ADSORPTION,
2023 OIL-WATER SEPARATION, WASTEWATER TREATMENT, *COANDA EFFECT,
2026 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION,
2027 OIL-WATER SEPARATION, HYDROCARBONS, ABSORPTION,
2032 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ADSORPTION,
2033 OIL-WATER SEPARATION, EMULSIONS, FILTRATION, *DRILLING FLUIDS,
2034 OIL-WATER SEPARATION, WASTEWATERS, TANKERS, FLOCCULATION,
2037 OIL-WATER SEPARATION, SHIPS, ECONOMICS, US COAST GUARD,
2041 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, DISPERSIONS,
2042 OIL-WATER SEPARATION, EMULSIONS, *DEMULSIFICATION,
2044 OIL-WATER SEPARATION, WASTEWATER TREATMENT,
2045 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, FLOCCULATION,
2046 OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, REFINERIES, PETROCHEMICALS,
2083 OIL-WATER SEPARATION, POLLUTION PREVENTION, BALLAST, TANKERS, ESTUARIES, UK, NORTH SEA,
1762 OIL WELLS, BLOWOUT PREVENTION, USSR, *NUCLEAR EXPLOSION,
2015 OIL WELLS, OIL-WATER SEPARATION, EMULSIONS,
2063 OIL WELLS, PERSONNEL TRAINING, BLOWOUT PREVENTION, DRILLING,
2075 OIL WELLS, BLOWOUT PREVENTION, DESIGN-ENGINEERING, DRILLING,
2080 OIL WELLS, BLOWOUT PREVENTION, POLLUTION PREVENTION, DESIGN-ENGINEERING,
2152 OIL WELLS, DRILLING, CONTAMINANTS, ENVIRONMENTAL EFFECTS, TOXICITY, GROUNDWATER,
2172 OIL WELLS, DRILLING, ENVIRONMENTAL EFFECTS, LEAKAGE, WASTEWATER DISPOSAL,
1955 OXIDATION, REFINERIES, WASTEWATER TREATMENT, PH CONTROL,
1960 OXIDATION, WASTE OIL TREATMENT, EMULSIONS, *DEMULSIFICATION,
2107 OXIDATION, BIOLOGICAL EFFECTS,CRUDE OIL, PHYTOPLANKTON, ALGAE, *PHOTO
1816 PACIFIC OCEAN, SAMPLING, TAR, MARINE ORGANISMS,
2153 PACIFIC OCEAN, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PORTS, TANKERS,
2244 PACIFIC OCEAN, FATE, HYDROCARBONS, MONITORING, DETECTION, TAR, BIODEGRADATION,
2245 PACIFIC OCEAN, SOURCE IDENTIFICATION, TAR, TANKERS, OIL DISCHARGES,
1782 PAH, MONITORING, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS, CARCINOGENS, CHROMATOGRAPHY, *MUSSELS,
1820 PAH, SAMPLING, HYDROCARBONS, ESTUARIES, ENGLAND, *EPIPELIC DIATOMS,
1821 PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SAMPLING,
1824 PAH, ANALYTICAL TECHNIQUES, DETECTION, CHROMATOGRAPHY, SPECTROMETRY,
1826 PAH, CHEMICAL ANALYSIS, WASTEWATERS, CHROMATOGRAPHY, *FLUORIMETRY,
1832 PAH, DETECTION, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CARCINOGENS,
1833 PAH, CHEMICAL ANALYSIS, CHROMATOGRAHPY, CARCINOGENS, *FRAGMENTOGRAPHY,
1838 PAH, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS , CARCINOGENS, *FLUORESCENCE,
1842 PAH, DETECTION, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1846 PAH, SOURCE IDENTIFICATION, AROMATIC HYDROCARBONS , CARCINOGENS, CONTAMINATION, CANADA,
2087 PAH, TOXICITY, CARCINOGENS, *PHOTOTOXICITY,
2143 PAH, BIOLOGICAL EFFECTS, SEDIMENTS, MARINE ORGANISMS, BALTIC SEA, ANALYTICAL TECHNIQUES,
2149 PAH, CARCINOGENS, ENVIRONMENTAL EFFECTS,
2229 PAH, HYDROCARBONS, CONTAMINATION, RIVERS, UK, *POTABLE WATER,
2235 PAH, FATE, ENVIRONMENTAL EFFECTS, *SOURCES, *TRANSPORT,
1878 PERSONNEL TRAINING, OIL SPILLS, CLEANUP, MONITORING, MEDITERRANEAN SEA,
2061 PERSONNEL TRAINING, POLLUTION PREVENTION, MEDITERRANEAN SEA,
2062 PERSONNEL TRAINING, OIL SPILLS, CLEANUP,
2063 PERSONNEL TRAINING, BLOWOUT PREVENTION, DRILLING, OIL WELLS,
2064 PERSONNEL TRAINING, BLOWOUT PREVENTION, DRILLING, TEXAS,
1945 PETROCHEMICALS, OIL TRANSPORT, REGULATIONS,
1974 PETROCHEMICALS, POLLUTION PREVENTION, WASTEWATER TREATMENT, INDUSTRIES,
1992 PETROCHEMICALS, WASTE OIL DISPOSAL, INCINERATION,
2002 PETROCHEMICALS, WASTEWATER TREATMENT, *VERMICULITE,

2020 PETROCHEMICALS, WASTEWATER TREATMENT, REFINERIES, *BIOLOGICAL TREATMENT,
2040 PETROCHEMICALS, OIL INDUSTRY, WASTEWATER TREATMENT, JAPAN,
2046 PETROCHEMICALS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, REFINERIES,
2099 PETROCHEMICALS, TOXICITY, FISHES, CRUSTACEANS, OIL DISCHARGES,
2112 PETROCHEMICALS, BIOLOGICAL EFFECTS, TOXICITY, FISHES,
1955 PH CONTROL, REFINERIES, WASTEWATER TREATMENT, OXIDATION,
1953 PHYSICAL EFFECTS, OIL TRANSFER, FATE, HYDROCARBONS, WEATHERING,
2142 PHYSICAL EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, CANADA, ARCTIC, PHYSICAL EFFECTS, *THAW DEPTH,
2216 PHYSICAL EFFECTS, OIL SPILLS, ARCTIC, SPREADING, *OIL UNDER ICE,
2102 PHYTOPLANKTON, BIOLOGICAL EFFECTS, OIL SPILLS, PIPELINES, CANADA, PLANTS,
2107 PHYTOPLANKTON, BIOLOGICAL EFFECTS, CRUDE OIL, ALGAE, *PHOTOOXIDATION,
2124 PHYTOPLANKTON, OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, BENTHOS, MICROORGANISMS, RESTORATION,
1942 PIPELINES, OIL SPILLS, ENVIRONMENTAL EFFECTS, SOIL, RESTORATION, CANADA,
1944 PIPELINES, OIL TANKS, LEAKAGE, GROUNDWATER, POLLUTION PREVENTION,
1946 PIPELINES, ALASKA, ENVIRONMENTAL EFFECTS, EXPLORATION, OIL TRANSPORT, *INDICATOR ORGANISMS, *ARCTIC FOX,
1949 PIPELINES, STATISTICAL ANALYSIS, OIL TRANSPORT, TANKERS, OCS, *ONSHORE TERMINAL,
2076 PIPELINES, LEAKAGE, POLLUTION PREVENTION, DESIGN-ENGINEERING,
2081 PIPELINES, POLLUTION PREVENTION, GROUNDWATER, *CORROSION,
2102 PIPELINES, BIOLOGICAL EFFECTS, OIL SPILLS, CANADA, PLANTS, PHYTOPLANKTON,
2140 PIPELINES, GROUNDWATER, CONTAMINATION, OIL SPILLS, STORAGE, LEAKAGE, CANADA,
1781 PLANKTON, MONITORING, BIOLOGICAL EFFECTS, BIOMASS, OIL INDUSTRY, ENGLAND,
2095 PLANKTON, TOXICITY, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, FISHES, ALGAE,
2088 PLANTS, BIOLOGICAL EFFECTS, OIL SPILLS, WASHINGTON, *ALPINE HABITAT,
2091 PLANTS, HYDROCARBONS, TOXICITY, *ELECTROLYTE LOSS,
2097 PLANTS, OIL SPILLS, NATURAL SEEPAGE, ARCTIC, BIOLOGICAL EFFECTS, RESTORATION, ALASKA,
2101 PLANTS, BIOLOGICAL EFFECTS, WASTE OIL, CRANKCASE OIL, SOIL,
2102 PLANTS, BIOLOGICAL EFFECTS, OIL SPILLS, PIPELINES, CANADA, PHYTOPLANKTON,
2105 PLANTS, BIOLOGICAL EFFECTS, OIL SPILLS, CANADA, ARCTIC,
2114 PLANTS, BIOLOGICAL EFFECTS, CONTAMINANTS, OCEANS,
2142 PLANTS, BIOLOGICAL EFFECTS, OIL SPILLS, CANADA, ARCTIC, PHYSICAL EFFECTS, *THAW DEPTH,
2205 PLANTS, BIODEGRADATION, SOIL, MONITORING,
1746 POLLUTION PREVENTION, OIL SPILLS, LAW ENFORCEMENT, ENGLAND, *ACOPS,
1747 POLLUTION PREVENTION, CONTAMINATION, GROUNDWATER, OIL TANKS, LEAKAGE, REGULATIONS,
1748 POLLUTION PREVENTION, CLEANUP, OIL SPILLS, CHESAPEAKE BAY, *US COAST GUARD,
1772 POLLUTION PREVENTION, MONITORING, WASTEWATERS, REFINERIES, OIL TRANSFER, OFFSHORE DRILLING, OIL SPILLS,
1796 POLLUTION PREVENTION, MONITORING, WASTE OIL, CHEMICAL ANALYSIS, NEW YORK, *BUFFALO RIVER,
1803 POLLUTION PREVENTION, REMOTE SENSING, OIL SPILLS, CLEANUP, *US COAST GUARD,
1886 POLLUTION PREVENTION, OIL SPILLS, RECOVERY, INTERNATIONAL AGREEMENTS, US, FRANCE,
1905 POLLUTION PREVENTION, OIL SPILLS, SHORELINES, ABSORPTION, DESIGN-ENGINEERING,
1907 POLLUTION PREVENTION, GOVERNMENT AGENCIES, CANADA, CLEANUP, OIL SPILLS, EIS,
1939 POLLUTION PREVENTION, OIL TRANSFER, TANKERS, ENGLAND, OIL SPILLS, CLEANUP,
1941 POLLUTION PREVENTION, STORAGE, HYDROCARBONS, REGULATIONS, *UNDERGROUND CAVERNS,
1943 POLLUTION PREVENTION, TANKERS, ECONOMICS, DESIGN-ENGINEERING, SEGREGATED BALLAST , LOAD-ON-TOP,
1944 POLLUTION PREVENTION, PIPELINES, OIL TANKS, LEAKAGE, GROUNDWATER,
1947 POLLUTION PREVENTION, TANKERS, SHIPS, OIL-WATER SEPARATION, BILGES, BALLAST, *DUBAI DRY DOCK,
1950 POLLUTION PREVENTION, TANKERS, OIL DISCHARGES, SEGREGATED BALLAST ,
1974 POLLUTION PREVENTION, WASTEWATER TREATMENT, INDUSTRIES, PETROCHEMICALS,
2061 POLLUTION PREVENTION, PERSONNEL TRAINING, MEDITERRANEAN SEA,
2068 POLLUTION PREVENTION, CONTAINMENT, OIL SPILLS,
2070 POLLUTION PREVENTION, LEAKAGE, OIL SPILLS, OIL TANKS,
2072 POLLUTION PREVENTION, OIL SPILLS, OIL TANKS, LEAKAGE,
2073 POLLUTION PREVENTION, OIL SPILLS, INLAND, LEGISLATION,
2076 POLLUTION PREVENTION, PIPELINES, LEAKAGE, DESIGN-ENGINEERING,
2077 POLLUTION PREVENTION, MANUALS, OIL SPILLS, LEAKAGE, OIL DISCHARGES, LEGISLATION,
2078 POLLUTION PREVENTION, OIL SPILLS, GROUNDWATER, CANADA, LEGISLATION, MANUALS, OIL INDUSTRY,
2080 POLLUTION PREVENTION, BLOWOUT PREVENTION, OIL WELLS, DESIGN-ENGINEERING,
2081 POLLUTION PREVENTION, GROUNDWATER, PIPELINES, *CORROSION,
2083 POLLUTION PREVENTION, OIL-WATER SEPARATION, BALLAST, TANKERS, ESTUARIES, UK, NORTH SEA,
2132 POLLUTION PREVENTION, ECONOMIC EFFECTS, OIL INDUSTRY, CLEANUP, REGULATIONS,
2134 POLLUTION PREVENTION, ECONOMIC EFFECTS, REGULATIONS, GOVERNMENT AGENCIES,
2139 POLLUTION PREVENTION, HYDROCARBONS, ENVIRONMENTAL EFFECTS, FATE, MARINE ORGANISMS,
2170 POLLUTION PREVENTION, ENVIRONMENTAL EFFECTS, OFFSHORE-PRODUCTION, REFINERIES, MONITORING,
2210 POLLUTION PREVENTION, BIODEGRADATION, OIL SHALE, OIL SHALE DEVELOPMENT,

EXTRACTION,
2251 POLLUTION PREVENTION, LEGISLATION, US, *EPA,
2252 POLLUTION PREVENTION, LEGISLATION, OIL SPILLS, *NAVIGATION,
2259 POLLUTION PREVENTION, LEGISLATION, US, OFFSHORE-DRILLING, PORTS,
2266 POLLUTION PREVENTION, SHIPS, TANKERS, INTERNATIONAL CONVENTIONS, LEGISLATION, *IMCO,
2269 POLLUTION PREVENTION, OFFSHORE-DRILLING, BIOLOGICAL EFFECTS, NORTH SEA, NORWAY,
2273 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, OIL TRANSPORT, TANKERS, SHIPS, OFFSHORE-DEVELOPMENT,
2276 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, OIL SPILLS, LEGISLATION, US,
2278 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, CLEANUP,
2279 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, LAW ENFORCEMENT,
2281 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, OIL SPILLS, OIL TRANSPORT, SHIPS,
2282 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, STATE GOVERNMENTS, TANKERS, OIL SPILLS,
2284 POLLUTION PREVENTION, INTERNATIONAL AGREEMENTS, WATER QUALITY, ECOSYSTEMS, RHINE RIVER,
2153 PORTS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, TANKERS, PACIFIC OCEAN,
2226 PORTS, FATE, OIL SPILLS, BAHAMAS, ENVIRONMENTAL EFFECTS, OFFSHORE-DEVELOPMENT,
2230 PORTS, OIL SPILLS, MOVEMENT, OFFSHORE-DEVELOPMENT, NEW JERSEY, DELAWARE,
2231 PORTS, OIL SPILLS, MOVEMENT, MEXICO/GULF OF, OFFSHORE-DEVELOPMENT,
2250 PORTS, LEGISLATION, OFFSHORE-DEVELOPMENT, ECONOMIC EFFECTS,
2254 PORTS, LEGISLATION, US, LIABILITY, OIL SPILLS, TANKERS,
2259 PORTS, LEGISLATION, US, POLLUTION PREVENTION, OFFSHORE-DRILLING,
2261 PORTS, LEGISLATION, US, OIL TRANSFER, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
2262 PORTS, LEGISLATION, OFFSHORE-DEVELOPMENT, LIABILITY, OIL SPILLS, TANKERS,
2178 PRODUCTION, ENVIRONMENTAL EFFECTS, OFFSHORE-DRILLING, CONTAMINATION,
2186 PRODUCTION, OIL TRANSPORT, ARCTIC, ENVIRONMENTAL EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-OIL INDUSTRY,
2187 PRODUCTION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OFFSHORE-FISHERIES, NORTH SEA,
2191 PRODUCTION, OIL INDUSTRY, WATER QUALITY, *WATER RESOURCES,
2264 PRODUCTION, LEGISLATION, US, EXPLORATION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION,
1977 RECLAMATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2010 RECLAMATION, WASTE OIL, RECYCLING, WASTE OIL TREATMENT, REFINING, DISPOSAL ,
2047 RECLAMATION, WASTE OIL TREATMENT, LUBRICATING OIL,
2050 RECLAMATION, REFINING, LUBRICATING OIL, WASTE OIL TREATMENT, CONSERVATION, ECONOMICS,
2051 RECLAMATION, WASTE OIL TREATMENT, LUBRICATING OIL,
2055 RECLAMATION, WASTE OIL TREATMENT, LUBRICATING OIL,
2058 RECLAMATION, WASTE OIL, OIL INDUSTRY, *TESTING METHODS,
2059 RECLAMATION, RECYCLING, WASTE OIL, LUBRICATING OIL,
2060 RECLAMATION, REUSE, WASTE OIL, LUBRICATING OIL,
1742 RECOVERY, OIL SPILLS, FUEL OIL, CLEANUP, SKIMMERS, *GOWANUS CANAL,
1858 RECOVERY, CONTAINMENT, OIL SPILLS, COASTS, SHORELINES,
1868 RECOVERY, OIL SPILLS, CLEANUP, SKIMMERS,
1870 RECOVERY, CLEANUP, OIL SPILLS, *SEA SLED,
1871 RECOVERY, CLEANUP, CONTAINMENT, HYDROCARBONS, OIL SPILLS,
1873 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1874 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1876 RECOVERY, OIL SPILLS, OFFSHORE-DRILLING, NORTH SEA,
1877 RECOVERY, OIL SLICKS, ESTUARIES, OIL-WATER SEPARATION, CLEANUP,
1879 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1880 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1881 RECOVERY, OIL SPILLS, ABSORPTION, DESIGN-ENGINEERING,
1883 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1886 RECOVERY, POLLUTION PREVENTION, OIL SPILLS, INTERNATIONAL AGREEMENTS, US, FRANCE,
1891 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1892 RECOVERY, OIL SPILLS, CONTAINMENT, CLEANUP, OIL-WATER SEPARATION, DISPOSAL ,
1895 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1897 RECOVERY, DETECTION, CONTAMINANTS, GROUNDWATER, DESIGN-ENGINEERING,
1899 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1900 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1901 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1902 RECOVERY, CLEANUP, OIL SPILLS, *COMPUTER SIMULATION,
1904 RECOVERY, OIL SPILLS, ARCTIC, FUEL OIL, CRUDE OIL, *OPERATIONS TESTS,
1906 RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING, *SYSTEMS TESTS,
1908 RECOVERY, OIL SLICKS, SPREADING, CLEANUP, TOXICITY, *OIL HERDER,
1910 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1916 RECOVERY, OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING,

1918 RECOVERY, OIL SLICKS, CLEANUP, ADSORPTION,
1919 RECOVERY, CLEANUP, OIL SLICKS, ADSORPTION,
1920 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING, *SYSTEM ANALYSIS,
1921 RECOVERY, OIL SPILLS, CLEANUP, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1923 RECOVERY, CRUDE OIL, *SUNKEN SHIPS, DESIGN-ENGINEERING,
1924 RECOVERY, OIL SPILLS, OIL-WATER SEPARATION, SHIPS, DESIGN-ENGINEERING,
1925 RECOVERY, OIL SPILLS, CRUDE OIL, FUEL OIL, SKIMMERS, DESIGN-ENGINEERING,
1927 RECOVERY, DETECTION, DESIGN-ENGINEERING, *OIL-WATER INTERFACE DETECTOR,
1928 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1930 RECOVERY, OIL SPILLS, DESIGN-ENGINEERING, *OIL RESISTANT FABRIC,
1931 RECOVERY, OIL SPILLS, CLEANUP, SKIMMERS, DESIGN-ENGINEERING,
1932 RECOVERY, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING,
1933 RECOVERY, CLEANUP, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
1994 RECOVERY, WASTE OIL TREATMENT, DISPOSAL , LEGISLATION, GERMANY, WEST,
1996 RECOVERY, WASTEWATER TREATMENT, WASTE OIL TREATMENT,
2010 RECYCLING, WASTE OIL, RECLAMATION, WASTE OIL TREATMENT, REFINING, DISPOSAL
2039 RECYCLING, REFINERIES, WASTEWATER TREATMENT, WASTEWATER DISPOSAL, SLUDGE,
2048 RECYCLING, REFINING, LUBRICATING OILS, WASTE OIL TREATMENT,
2052 RECYCLING, REFINERIES, WASTEWATER TREATMENT, REUSE,
2054 RECYCLING, WASTE OIL, REUSE, LUBRICATING OIL, LEGISLATION, US,
2056 RECYCLING, INFORMATION SYSTEMS, WASTE OIL,
2057 RECYCLING, WASTE OIL, DESIGN-ENGINEERING, SKIMMERS,
2059 RECYCLING, RECLAMATION, WASTE OIL, LUBRICATING OIL,
1772 REFINERIES, MONITORING, WASTEWATERS, OIL TRANSFER, OFFSHORE DRILLING, OIL SPILLS, POLLUTION PREVENTION,
1814 REFINERIES, SAMPLING, CHEMICAL ANALYSIS, WASTEWATERS,
1815 REFINERIES, SAMPLING, CHEMICAL ANALYSIS, WASTEWATERS,
1825 REFINERIES, TOXICITY, WASTEWATERS, *DAPHIA PULEX,
1940 REFINERIES, STORAGE, CRUDE OIL, ENVIRONMENTAL EFFECTS, SCOTLAND, *UNDERGROUND STORAGE,
1951 REFINERIES, OIL TRANSPORT, SHIPS, DELAWARE BAY, *SPORT FISHING,
1955 REFINERIES, WASTEWATER TREATMENT, OXIDATION, PH CONTROL,
1957 REFINERIES, WASTEWATER TREATMENT, FILTRATION,
1962 REFINERIES, WASTEWATER TREATMENT, CANADA, WATER QUALITY,
1964 REFINERIES, WASTEWATER TREATMENT, ENVIRONMENTAL MANAGEMENT, ECONOMICS,
1969 REFINERIES, WASTEWATER TREATMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, SHIPS,
1975 REFINERIES, WASTEWATERS, SAMPLING, CHEMICAL ANALYSIS,
1985 REFINERIES, WASTEWATER TREATMENT, SLUDGE,
1989 REFINERIES, WASTE OIL TREATMENT, WASTEWATER TREATMENT, OIL-WATER SEPARATION, JAPAN,
1993 REFINERIES, WASTEWATER TREATMENT, ACTIVATED SLUDGE , GUIDELINES,
1997 REFINERIES, WASTEWATERS, OIL INDUSTRY, ANALYTICAL TECHNIQUES, *HUNGARY,
2003 REFINERIES, WASTEWATER TREATMENT, ACTIVATED SLUDGE ,
2004 REFINERIES, WASTEWATERS, ACTIVATED SLUDGE ,
2012 REFINERIES, DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, CHILE,
2016 REFINERIES, WASTEWATER TREATMENT, FILTRATION, COAGULATION,
2019 REFINERIES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION,
2020 REFINERIES, WASTEWATER TREATMENT, PETROCHEMICALS, *BIOLOGICAL TREATMENT,
2028 REFINERIES, WASTEWATER TREATMENT, FLOCCULATION,
2029 REFINERIES, WASTEWATER TREATMENT, TEXAS, *ACTIVATED CARBON,
2031 REFINERIES, WASTEWATER TREATMENT, *PHENOLS, BIBLIOGRAPHIES,
2035 REFINERIES, WASTEWATER TREATMENT, WATER QUALITY, EUROPE,
2033 REFINERIES, WASTEWATER TREATMENT, EVAPORATION,
2039 REFINERIES, WASTEWATER TREATMENT, WASTEWATER DISPOSAL, RECYCLING, SLUDGE,
2046 REFINERIES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, PETROCHEMICALS,
2052 REFINERIES, WASTEWATER TREATMENT, REUSE, RECYCLING,
2136 REFINERIES, WASTEWATERS, OIL SPILLS, MONITORING, TOXICITY, *RESEARCH PROGRAM, ENGLAND,
2160 REFINERIES, REGULATIONS, ECONOMIC EFFECTS,
2169 REFINERIES, ENVIRONMENTAL PROTECTION, SCOTLAND, CONTINGENCY PLANNING, OIL SPILLS, MONITORING,
2170 REFINERIES, ENVIRONMENTAL EFFECTS, OFFSHORE-PRODUCTION, POLLUTION PREVENTION, MONITORING,
2260 REFINERIES, REGULATIONS, GUIDELINES, WASTEWATER TREATMENT,
2010 REFINING, WASTE OIL, RECLAMATION, RECYCLING, WASTE OIL TREATMENT, DISPOSAL ,
2048 REFINING, RECYCLING, LUBRICATING OILS, WASTE OIL TREATMENT,
2050 REFINING, RECLAMATION, LUBRICATING OIL, WASTE OIL TREATMENT, CONSERVATION, ECONOMICS,
2189 REFINING, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, OIL DISCHARGES, USSR,
1743 REGULATIONS, OIL SPILLS, FUEL OIL, CHESAPEAKE BAY, US, *US COAST GUARD,
1747 REGULATIONS, CONTAMINATION, GROUNDWATER, OIL TANKS, LEAKAGE, POLLUTION PREVENTION,
1802 REGULATIONS, REMOTE SENSING, OIL SPILLS, DETECTION, MONITORING,
1941 REGULATIONS, STORAGE, HYDROCARBONS, POLLUTION PREVENTION, *UNDERGROUND CAVERNS,
1945 REGULATIONS, OIL TRANSPORT, PETROCHEMICALS,
2132 REGULATIONS, ECONOMIC EFFECTS, OIL INDUSTRY, CLEANUP, POLLUTION PREVENTION,

2134 REGULATIONS, ECONOMIC EFFECTS, POLLUTION PREVENTION, GOVERNMENT AGENCIES,
2160 REGULATIONS, REFINERIES, ECONOMIC EFFECTS,
2246 REGULATIONS, OIL SPILLS, LIABILITY, OREGON,
2247 REGULATIONS, OIL SPILLS, CLEANUP, OREGON,
2248 REGULATIONS, OIL DISCHARGES, INLAND, ALASKA, *OILING PERMITS,
2260 REGULATIONS, GUIDELINES, WASTEWATER TREATMENT, REFINERIES,
2263 REGULATIONS, LIABILITY, OIL DISCHARGES, *HAZARDOUS SUBSTANCES,
2268 REGULATIONS, TANKERS, OIL TRANSPORT, INTERNATIONAL CONVENTIONS,
2270 REGULATIONS, OIL INDUSTRY, ENVIRONMENTAL PROTECTION, *NIGERIA,
2274 REGULATIONS, INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, OIL DISCHARGES, SHIPS,
2286 REGULATIONS, ENVIRONMENTAL PROTECTION, OFFSHORE-DEVELOPMENT, GOVERNMENT AGENCIES,
1774 REMOTE SENSING, MONITORING, DETECTION, *OIL POLLUTANTS, DESIGN-ENGINEERING, TOXICITY,
1787 REMOTE SENSING, MONITORING, OIL SLICKS, MOVEMENT,
1797 REMOTE SENSING, DETECTION, OIL SPILLS, DESIGN-ENGINEERING, US COAST GUARD,
1798 REMOTE SENSING, OIL SPILLS, SPREADING, GERMANY, WEST,
1799 REMOTE SENSING, OIL SPILLS, MOVEMENT, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA COAST,
1800 REMOTE SENSING, BALTIC SEA, *OIL POLLUTION,
1801 REMOTE SENSING, DETECTION, SOURCE IDENTIFICATION, OIL SPILLS, *FLUORESCENCE,
1802 REMOTE SENSING, OIL SPILLS, DETECTION, MONITORING, REGULATIONS,
1803 REMOTE SENSING, OIL SPILLS, POLLUTION PREVENTION, CLEANUP, *US COAST GUARD,
1804 REMOTE SENSING, OIL SLICKS, MOVEMENT, COASTS, ESTUARIES, DELAWARE BAY, *LANDSAT,
1805 REMOTE SENSING, OIL SLICKS, MOVEMENT, DELAWARE BAY, *LANDSAT,
1806 REMOTE SENSING, DETECTION, OIL SPILLS, NATURAL SEEPAGE, CALIFORNIA COAST,
1807 REMOTE SENSING, ESTUARIES, SHORELINES, ECOSYSTEMS, *OIL POLLUTION,
1808 REMOTE SENSING, OIL SPILLS, NATURAL SEEPAGE, MONITORING, *ERTS-1,
1809 REMOTE SENSING, OIL SLICKS, OIL SPILLS, MONITORING, ST. LAWRENCE RIVER, BAHAMAS,
2238 REMOTE SENSING, FATE, OIL SLICKS, MOVEMENT, CANADA, *OIL-ICE INTERACTION,
2106 RESOURCE MANAGEMENT, BIOLOGICAL EFFECTS, OIL SPILLS, INFORMATION SYSTEMS, RESOURCE MANAGEMENT, WASHINGTON,
1771 RESTORATION, OIL SPILLS, *ALERT BAY OIL SPILL,
1926 RESTORATION, CLEANUP, BEACHES, SURFACTANTS,
1936 RESTORATION, SOIL, CONTAMINATION, OIL SPILLS, CLEANUP,
1942 RESTORATION, OIL SPILLS, PIPELINES, ENVIRONMENTAL EFFECTS, SOIL, CANADA,
2097 RESTORATION, OIL SPILLS, NATURAL SEEPAGE, ARCTIC, BIOLOGICAL EFFECTS, PLANTS, ALASKA,
2117 RESTORATION, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, CHEDABUCTO BAY,
2124 RESTORATION, OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, BENTHOS, PHYTOPLANKTON, MICROORGANISMS,
2130 RESTORATION, BIOLOGICAL EFFECTS, OIL SPILLS, BEACHES, INVERTEBRATES, CHINA, *MEIOFAUNA,
2141 RESTORATION, BIOLOGICAL EFFECTS, OIL DISCHARGES, BALLAST, BEACHES, CLEANUP, IRELAND,
2221 RESTORATION, WEATHERING, SEDIMENTS, FATE, OIL SPILLS, CANADA, CHEDABUCTO BAY,
2011 REUSE, WASTEWATER DISPOSAL, WASTE OIL, FUELS,
2049 REUSE, WASTE OIL, LUBRICATING OIL, FUELS,
2052 REUSE, REFINERIES, WASTEWATER TREATMENT, RECYCLING,
2053 REUSE, WASTE OIL, LUBRICATING OIL, FUELS,
2054 REUSE, WASTE OIL, RECYCLING, LUBRICATING OIL, LEGISLATION, US,
2060 REUSE, RECLAMATION, WASTE OIL, LUBRICATING OIL,
1788 RHINE RIVER, MONITORING, CONTAMINATION, *MAAS RIVER, EUROPE,
2284 RHINE RIVER, INTERNATIONAL AGREEMENTS, WATER QUALITY, POLLUTION PREVENTION, ECOSYSTEMS,
2229 RIVERS, PAH, HYDROCARBONS, CONTAMINATION, UK, *POTABLE WATER,
1765 SAMPLING, TAR, NORWEGIAN SEA,
1790 SAMPLING, MONITORING, OIL DISCHARGES, WASTEWATERS,
1794 SAMPLING, MONITORING, HYDROCARBONS, TAR, BEAUFORT SEA,
1810 SAMPLING, OIL SPILLS, ADSORPTION,
1811 SAMPLING, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, OIL SPILLS, INDUSTRIES, CLEANUP,
1812 SAMPLING, MONITORING, MEDITERRANEAN SEA, *OIL AGGREGATES, *DISTRIBUTION,
1813 SAMPLING, NATURAL SEEPAGE, ALASKA, *ALASKA PENINSULA,
1814 SAMPLING, CHEMICAL ANALYSIS, WASTEWATERS, REFINERIES,
1815 SAMPLING, CHEMICAL ANALYSIS, WASTEWATERS, REFINERIES,
1816 SAMPLING, TAR, MARINE ORGANISMS, PACIFIC OCEAN,
1817 SAMPLING, TAR, MEDITERRANEAN SEA, MONITORING,
1818 SAMPLING, CONTAMINATION, BEACHES, *BAJA CALIFORNIA, FUELS,
1819 SAMPLING, TAR, CARIBBEAN SEA, ATLANTIC OCEAN,
1820 SAMPLING, HYDROCARBONS, PAH, ESTUARIES, ENGLAND, *EPIPELIC DIATOMS,
1821 SAMPLING, CHEMICAL ANALYSIS, CHROMATOGRAPHY, PAH,
1823 SAMPLING, HYDROCARBONS, OCEANS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY,
1829 SAMPLING, ANALYTICAL TECHNIQUES, OIL SPILLS, BIOLOGICAL EFFECTS,
1831 SAMPLING, ANALYTICAL TECHNIQUES, CONTAMINANTS, OCEANS,

1834 SAMPLING, CHEMICAL ANALYSIS, COASTS, ITALY, OIL DISCHARGES, TANKERS,
1840 SAMPLING, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, SEDIMENTS, DELAWARE BAY, OIL SPILLS,
1848 SAMPLING, SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES, *US COAST GUARD,
1852 SAMPLING, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, *WATERBORNE OILS,
1935 SAMPLING, CONTAINMENT, MONITORING, NEW YORK, *OIL POLLUTANTS, *BUFFALO RIVER,
1975 SAMPLING, WASTEWATERS, REFINERIES, CHEMICAL ANALYSIS,
2151 SANTA BARBARA CHANNEL, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, OIL SPILLS, GUIDELINES,
1940 SCOTLAND, STORAGE, CRUDE OIL, REFINERIES, ENVIRONMENTAL EFFECTS, *UNDERGROUND STORAGE,
2169 SCOTLAND, REFINERIES, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, OIL SPILLS, MONITORING,
1822 SEAWATER, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEDIMENTS,
1837 SEAWATER, ANALYTICAL TECHNIQUES, HYDROCARBONS, CANADA, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
2193 SEAWATER, BIODEGRADATION, OIL SPILLS, EMULSIFIERS,
2199 SEAWATER, BIODEGRADATION, ANALYTICAL TECHNIQUES, *POLAROGRAPHIC RESPIROMETER,
2213 SEAWATER, HYDROCARBONS, *VAPOR-LIQUID EQUILIBRIUM STUDIES,
2223 SEAWATER, OIL TRANSFER, DECOMPOSITION, TOXICITY, FRESHWATER,
2225 SEAWATER, MONITORING, CRUDE OIL, SEDIMENTS, OIL TANKS, SPECTROSCOPY,
1782 SEDIMENTS, MONITORING, CONTAMINATION, MARINE ORGANISMS, CARCINOGENS, PAH, CHROMATOGRAPHY, *MUSSELS,
1822 SEDIMENTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, SEAWATER,
1828 SEDIMENTS, OIL SPILLS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, MAINE, *LONG COVE,
1836 SEDIMENTS, HYDROCARBONS, MEDITERRANEAN SEA, ANALYTICAL TECHNIQUES, SPECTROMETRY,
1839 SEDIMENTS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, FUEL OIL, HYDROCARBONS, MARINE ORGANISMS,
1840 SEDIMENTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, DELAWARE BAY, OIL SPILLS, SAMPLING,
1841 SEDIMENTS, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, JAPAN,
1970 SEDIMENTS, WASTEWATER TREATMENT, CLEANUP, OIL INDUSTRY,
2143 SEDIMENTS, BIOLOGICAL EFFECTS, PAH, MARINE ORGANISMS, BALTIC SEA, ANALYTICAL TECHNIQUES,
2201 SEDIMENTS, BIODEGRADATION, HYDROCARBONS, BACTERIA, ATLANTIC COAST, OIL SPILLS, CLEANUP,
2202 SEDIMENTS, BIODEGRADATION, CRUDE OIL, BACTERIA, ALASKA,
2221 SEDIMENTS, RESTORATION, WEATHERING, FATE, OIL SPILLS, CANADA, CHEDABUCTO BAY,
2225 SEDIMENTS, MONITORING, CRUDE OIL, SEAWATER, OIL TANKS, SPECTROSCOPY,
2234 SEDIMENTS, OIL SPILLS, HYDROCARBONS, ESTUARIES, RHODE ISLAND, BIODEGRADATION,
1943 SEGREGATED BALLAST , POLLUTION PREVENTION, TANKERS, ECONOMICS, DESIGN-ENGINEERING, LOAD-ON-TOP,
1950 SEGREGATED BALLAST , TANKERS, OIL DISCHARGES, POLLUTION PREVENTION,
1753 SHIPS, OIL DISCHARGES, OCEANS, SOURCE IDENTIFICATION, TANKERS,
1768 SHIPS, OIL SPILLS, TANKERS, BEACHES, CRUDE OIL, NEW YORK,
1785 SHIPS, MONITORING, BILGES, DESIGN-ENGINEERING,
1847 SHIPS, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OCEANS, TANKERS,
1923 SHIPS, RECOVERY, CRUDE OIL, *SUNKEN DESIGN-ENGINEERING,
1924 SHIPS, OIL SPILLS, RECOVERY, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1938 SHIPS, OIL-WATER SEPARATION, BALLAST, OIL TANKS, DESIGN-ENGINEERING,
1947 SHIPS, POLLUTION PREVENTION, TANKERS, OIL-WATER SEPARATION, BILGES, BALLAST, *DUBAI DRY DOCK,
1951 SHIPS, OIL TRANSPORT, REFINERIES, DELAWARE BAY, *SPORT FISHING,
1966 SHIPS, OIL-WATER SEPARATION, FUEL OIL, SLUDGE,
1969 SHIPS, WASTEWATER TREATMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, REFINERIES,
1991 SHIPS, OIL-WATER SEPARATION, WASTEWATERS, DESIGN-ENGINEERING,
2037 SHIPS, OIL-WATER SEPARATION, ECONOMICS, US COAST GUARD,
2120 SHIPS, TANKERS, *OIL POLLUTION,
2266 SHIPS, POLLUTION PREVENTION, TANKERS, INTERNATIONAL CONVENTIONS, LEGISLATION, *IMCO,
2267 SHIPS, LIABILITY, OIL TRANSPORT, INTERNATIONAL CONVENTIONS, *VESSEL-SOURCE POLLUTION,
2273 SHIPS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL TRANSPORT, TANKERS, OFFSHORE-DEVELOPMENT,
2274 SHIPS, INTERNATIONAL CONVENTIONS, MEDITERRANEAN SEA, REGULATIONS, OIL DISCHARGES,
2281 SHIPS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL SPILLS, OIL TRANSPORT,
1807 SHORELINES, REMOTE SENSING, ESTUARIES, ECOSYSTEMS, *OIL POLLUTION,
1858 SHORELINES, CONTAINMENT, RECOVERY, OIL SPILLS, COASTS,
1905 SHORELINES, OIL SPILLS, POLLUTION PREVENTION, ABSORPTION, DESIGN-ENGINEERING,
2118 SHORELINES, BIRDS, NORWAY, BIOLOGICAL EFFECTS, OFFSHORE-DRILLING, NORTH SEA,
1909 SINKING AGENTS, CLEANUP, OIL SPILLS,
1742 SKIMMERS, OIL SPILLS, FUEL OIL, CLEANUP, RECOVERY, *GOWANUS CANAL,
1868 SKIMMERS, OIL SPILLS, CLEANUP, RECOVERY,
1874 SKIMMERS, OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,

1879 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1880 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1883 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1885 SKIMMERS, CLEANUP, OIL SPILLS, DESIGN-ENGINEERING,
1890 SKIMMERS, CLEANUP, CONTAINMENT, OIL SPILLS, *SORBENTS, *PISTON FILMS,
1896 SKIMMERS, OIL SPILLS, WEATHERING, CLEANUP, BOOMS, ABSORPTION,
1899 SKIMMERS, OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
1900 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1901 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1906 SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING, *SYSTEMS TESTS,
1925 SKIMMERS, OIL SPILLS, CRUDE OIL, FUEL OIL, RECOVERY, DESIGN-ENGINEERING,
1931 SKIMMERS, OIL SPILLS, CLEANUP, RECOVERY, DESIGN-ENGINEERING,
1933 SKIMMERS, CLEANUP, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
1965 SKIMMERS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
2057 SKIMMERS, RECYCLING, WASTE OIL, DESIGN-ENGINEERING,
1961 SLUDGE, WASTE OIL TREATMENT, OIL-WATER SEPARATION,
1966 SLUDGE, OIL-WATER SEPARATION, FUEL OIL, SHIPS,
1967 SLUDGE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1985 SLUDGE, WASTEWATER TREATMENT, REFINERIES,
2007 SLUDGE, WASTE OIL DISPOSAL, INCINERATION,
2039 SLUDGE, REFINERIES, WASTEWATER TREATMENT, WASTEWATER DISPOSAL, RECYCLING,
2179 SOCIAL EFFECTS, ENVIRONMENTAL EFFECTS, OIL SHALE DEVELOPMENT, *OIL POLLUTION,
2158 SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, OCS, OFFSHORE DEVELOPMENT,
2161 SOCIO-ECONOMIC EFFECTS, OIL-GAS LEASING, OCS, ATLANTIC COAST, *ONSHORE IMPACTS,
2176 SOCIO-ECONOMIC EFFECTS, OIL SHALE DEVELOPMENT, ENVIRONMENTAL EFFECTS, *PICEANCE BASIN,
2180 SOCIO-ECONOMIC EFFECTS, OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, ENVIRONMENTAL EFFECTS, ATLANTIC COAST,
2190 SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, *ENERGY DEVELOPMENT, *OIL POLLUTION,
1936 SOIL, RESTORATION, CONTAMINATION, OIL SPILLS, CLEANUP,
1942 SOIL, OIL SPILLS, PIPELINES, ENVIRONMENTAL EFFECTS, RESTORATION, CANADA,
2101 SOIL, BIOLOGICAL EFFECTS, WASTE OIL, CRANKCASE OIL, PLANTS,
2122 SOIL, CRUDE OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, ARCTIC,
2200 SOIL, BIODEGRADATION, CRUDE OIL, ARCTIC, FUNGI,
2205 SOIL, BIODEGRADATION, MONITORING, PLANTS,
2218 SOIL, HYDROCARBONS, ARCTIC, ADSORPTION,
2215 SOLUBILITY, HYDROCARBONS, FUEL OIL, CRUDE OIL,
1753 SOURCE IDENTIFICATION, OIL DISCHARGES, OCEANS, TANKERS, SHIPS,
1761 SOURCE IDENTIFICATION, OIL SPILLS, GROUNDWATER, CLEANUP,
1764 SOURCE IDENTIFICATION, DETECTION, OIL SPILLS, *RESEARCH SURVEY,
1801 SOURCE IDENTIFICATION, REMOTE SENSING, DETECTION, OIL SPILLS, *FLUORESCENCE,
1811 SOURCE IDENTIFICATION, SAMPLING, ANALYTICAL TECHNIQUES, OIL SPILLS, INDUSTRIES, CLEANUP,
1843 SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS,
1844 SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES, SPECTROSCOPY,
1845 SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, TANKERS, OIL INDUSTRY,
1846 SOURCE IDENTIFICATION, PAH, AROMATIC HYDROCARBONS , CARCINOGENS, CONTAMINATION, CANADA,
1847 SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OCEANS, TANKERS, SHIPS,
1848 SOURCE IDENTIFICATION, CONTAMINATION, CHEMICAL ANALYSIS, COASTS, INDIA,
1848 SOURCE IDENTIFICATION, OIL SPILLS, SAMPLING, ANALYTICAL TECHNIQUES, *US COAST GUARD,
1850 SOURCE IDENTIFICATION, CHEMICAL ANALYSIS, CHROMATOGRAPHY, OIL SPILLS,
1851 SOURCE IDENTIFICATION, OIL SPILLS, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1852 SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, SAMPLING, *WATERBORNE OILS,
2123 SOURCE IDENTIFICATION, BIOLOGICAL EFFECTS, CONTAMINATION, HEALTH HAZARDS, SOURCE IDENTIFICATION, BIBLIOGRAPHIES,
2211 SOURCE IDENTIFICATION, WEATHERING, SPECTROSCOPY, NARRAGANSETT BAY,
2233 SOURCE IDENTIFICATION, OIL SPILLS, FATE, ARCTIC, WEATHERING, CLEANUP,
2245 SOURCE IDENTIFICATION, TAR, PACIFIC OCEAN, TANKERS, OIL DISCHARGES,
2280 SOURCE IDENTIFICATION, BIBLIOGRAPHIES, CHEMICAL ANALYSIS, OIL SLICKS, *PETROLEUM OILS,
1779 SOUTHERN CALIFORNIA, MONITORING, CONTAMINATION, OCS, OFFSHORE DRILLING, *BARIUM CONCENTRATIONS,
2065 SOUTHERN CALIFORNIA, CONTINGENCY PLANNING, OIL SPILLS, OCS,
1741 SPAIN, OIL SPILLS, TANKERS, FISHERIES, BEACHES, CLEANUP, *CORUNA OIL SPILL,
1823 SPECTROMETRY, HYDROCARBONS, OCEANS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SAMPLING,
1824 SPECTROMETRY, ANALYTICAL TECHNIQUES, DETECTION, PAH, CHROMATOGRAPHY,
1827 SPECTROMETRY, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, FISHES,
1836 SPECTROMETRY, HYDROCARBONS, SEDIMENTS, MEDITERRANEAN SEA, ANALYTICAL TECHNIQUES,
1839 SPECTROSCOPY, ANALYTICAL TECHNIQUES, FUEL OIL, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS,
1844 SPECTROSCOPY, SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES,
2211 SPECTROSCOPY, WEATHERING, SOURCE IDENTIFICATION, NARRAGANSETT BAY,

2225 SPECTROSCOPY, MONITORING, CRUDE OIL, SEAWATER, SEDIMENTS, OIL TANKS,
2239 SPECTROSCOPY, WEATHERING, CHEMICAL ANALYSIS, CHROMATOGRAPHY, ENVIRONMENTAL EFFECTS,
1798 SPREADING, REMOTE SENSING, OIL SPILLS, GERMANY, WEST,
1908 SPREADING, OIL SLICKS, RECOVERY, CLEANUP, TOXICITY, *OIL HERDER,
2212 SPREADING, CRUDE OIL, COALESCENCE, EMULSIFICATION, *FRESHWATER ICE CONDITIONS,
2216 SPREADING, PHYSICAL EFFECTS, OIL SPILLS, ARCTIC, *OIL UNDER ICE,
2241 SPREADING, OIL SPILLS, FATE, WEATHERING, BIODEGRADATION,
2243 SPREADING, MODELS, OIL SPILLS, DRIFT, DELAWARE BAY,
1809 ST. LAWRENCE RIVER, REMOTE SENSING, OIL SLICKS, OIL SPILLS, MONITORING, BAHAMAS,
2224 ST. LAWRENCE RIVER, OIL SLICKS, FATE, ESTUARIES, CANADA,
1754 STATE GOVERNMENTS, ALASKA, ENVIRONMENTAL PROTECTION, OIL-GAS LEASING,
2282 STATE GOVERNMENTS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, TANKERS, OIL SPILLS,
1767 STATISTICAL ANALYSIS, ENVIRONMENTAL PROTECTION, GUIDELINES, *US COAST GUARD,
1949 STATISTICAL ANALYSIS, OIL TRANSPORT, PIPELINES, TANKERS, OCS, *ONSHORE TERMINAL,
1740 STATISTICS, OIL SPILLS, LIABILITY, GOVERNMENT AGENCIES, ENGLAND, *ACOPS,
1940 STORAGE, CRUDE OIL, REFINERIES, ENVIRONMENTAL EFFECTS, SCOTLAND, *UNDERGROUND
1941 STORAGE, HYDROCARBONS, POLLUTION PREVENTION, REGULATIONS, *UNDERGROUND CAVERNS,
1952 STORAGE, CRUDE OIL, ECONOMICS, *UNDERGROUND *SURFACE TANKS,
2140 STORAGE, GROUNDWATER, CONTAMINATION, OIL SPILLS, PIPELINES, LEAKAGE, CANADA,
2175 STORAGE, OFFSHORE-EXPLORATION, OFFSHORE-DEVELOPMENT, OIL TRANSPORT, ENVIRONMENTAL EFFECTS,
1926 SURFACTANTS, CLEANUP, BEACHES, RESTORATION,
1758 SWITZERLAND, LEAKAGE, OIL TANKS,
1741 TANKERS, OIL SPILLS, SPAIN, FISHERIES, BEACHES, CLEANUP, *CORUNA OIL SPILL,
1753 TANKERS, OIL DISCHARGES, OCEANS, SOURCE IDENTIFICATION, SHIPS,
1760 TANKERS, OIL SPILLS, ENVIRONMENTAL EFFECTS, METULA OIL SPILL, MAGELLAN/STRAIT OF,
1768 TANKERS, OIL SPILLS, SHIPS, BEACHES, CRUDE OIL, NEW YORK,
1834 TANKERS, SAMPLING, CHEMICAL ANALYSIS, COASTS, ITALY, OIL DISCHARGES,
1845 TANKERS, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OIL INDUSTRY,
1847 TANKERS, SOURCE IDENTIFICATION, OIL SPILLS, OIL DISCHARGES, OCEANS, SHIPS,
1937 TANKERS, OIL TRANSFER, OIL SPILLS, LEAKAGE, *SINGLE BUOY MOORING,
1939 TANKERS, OIL TRANSFER, ENGLAND, OIL SPILLS, POLLUTION PREVENTION, CLEANUP,
1943 TANKERS, POLLUTION PREVENTION, ECONOMICS, DESIGN-ENGINEERING, SEGREGATED BALLAST , LOAD-ON-TOP,
1947 TANKERS, POLLUTION PREVENTION, SHIPS, OIL-WATER SEPARATION, BILGES, BALLAST, *DUBAI DRY DOCK,
1948 TANKERS, OIL TRANSFER, CONTAINMENT, OIL SPILLS,
1949 TANKERS, STATISTICAL ANALYSIS, OIL TRANSPORT, PIPELINES, OCS, *ONSHORE TERMINAL,
1950 TANKERS, OIL DISCHARGES, POLLUTION PREVENTION, SEGREGATED BALLAST ,
1976 TANKERS, DISPERSIONS, OIL-WATER SEPARATION, COALESCENCE, BALLAST, BILGES,
1980 TANKERS, WASTEWATER TREATMENT, BALLAST, OIL-WATER SEPARATION,
2034 TANKERS, OIL-WATER SEPARATION, WASTEWATERS, FLOCCULATION,
2083 TANKERS, POLLUTION PREVENTION, OIL-WATER SEPARATION, BALLAST, ESTUARIES, UK, NORTH SEA,
2120 TANKERS, SHIPS, *OIL POLLUTION,
2133 TANKERS, OIL SPILLS, CLEANUP, ECONOMIC EFFECTS, DISPERSANTS, TOXICITY,
2153 TANKERS, BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PORTS, PACIFIC OCEAN,
2245 TANKERS, SOURCE IDENTIFICATION, TAR, PACIFIC OCEAN, OIL DISCHARGES,
2254 TANKERS, LEGISLATION, US, LIABILITY, OIL SPILLS, PORTS,
2262 TANKERS, LEGISLATION, OFFSHORE-DEVELOPMENT, PORTS, LIABILITY, OIL SPILLS,
2266 TANKERS, POLLUTION PREVENTION, SHIPS, INTERNATIONAL CONVENTIONS, LEGISLATION, *IMCO,
2268 TANKERS, REGULATIONS, OIL TRANSPORT, INTERNATIONAL CONVENTIONS,
2273 TANKERS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OIL TRANSPORT, SHIPS, OFFSHORE-DEVELOPMENT,
2282 TANKERS, INTERNATIONAL CONVENTIONS, STATE GOVERNMENTS, POLLUTION PREVENTION, OIL SPILLS,
2285 TANKERS, GUIDELINES, OIL TRANSPORT,
1765 TAR, SAMPLING, NORWEGIAN SEA,
1775 TAR, MONITORING, OIL SLICKS, OCEANS, BEACHES,
1794 TAR, MONITORING, HYDROCARBONS, BEAUFORT SEA, SAMPLING,
1795 TAR, MONITORING, NATURAL SEEPAGE, HYDROCARBONS, CHEMICAL ANALYSIS, BEAUFORT SEA, *DISTRIBUTION,
1816 TAR, SAMPLING, MARINE ORGANISMS, PACIFIC OCEAN,
1817 TAR, SAMPLING, MEDITERRANEAN SEA, MONITORING,
1819 TAR, SAMPLING, CARIBBEAN SEA, ATLANTIC OCEAN,
2228 TAR, JAPAN/SEA OF, *SESSILE ANIMALS,
2237 TAR, WEATHERING, CHEMICAL ANALYSIS, *FOULING ORGANISMS,
2244 TAR, FATE, HYDROCARBONS, MONITORING, DETECTION, BIODEGRADATION, PACIFIC OCEAN,
2245 TAR, SOURCE IDENTIFICATION, PACIFIC OCEAN, TANKERS, OIL DISCHARGES,
2029 TEXAS, WASTEWATER TREATMENT, REFINERIES, *ACTIVATED CARBON,
2064 TEXAS, BLOWOUT PREVENTION, PERSONNEL TRAINING, DRILLING,

1763 TOXICITY, OIL SPILLS, REEFS, INDIAN OCEAN,
1774 TOXICITY, MONITORING, DETECTION, REMOTE SENSING, *OIL POLLUTANTS, DESIGN-ENGINEERING,
1825 TOXICITY, WASTEWATERS, REFINERIES, *DAPHNIA PULEX,
1908 TOXICITY, OIL SLICKS, SPREADING, RECOVERY, CLEANUP, *OIL HERDER,
2091 TOXICITY, HYDROCARBONS, PLANTS, *ELECTROLYTE LOSS,
2093 TOXICITY, BIOLOGICAL EFFECTS, BACTERIA, AROMATIC HYDROCARBONS , MICROORGANISMS,
2094 TOXICITY, DISPERSANTS, CRUDE OIL, *COREXIT 9527,
2095 TOXICITY, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, FISHES, PLANKTON, ALGAE,
2099 TOXICITY, FISHES, CRUSTACEANS, PETROCHEMICALS, OIL DISCHARGES,
2100 TOXICITY, CRUDE OIL, FISHES, *TELEOSTS,
2110 TOXICITY, BIOLOGICAL EFFECTS, DISPERSANTS, FISHES, INVERTEBRATES, *COREXIT 9527,
2112 TOXICITY, BIOLOGICAL EFFECTS, PETROCHEMICALS, FISHES,
2116 TOXICITY, MARINE ORGANISMS, INVERTEBRATES, ARCTIC, CANADA,
2119 TOXICITY, FUEL OIL, CRUDE OIL, HYDROCARBONS, ANNELIDS, *POLYCHAETE WORMS,
2125 TOXICITY, FUEL OIL, CRUSTACEANS, *SHRIMP,
2129 TOXICITY, FUEL OIL, MICROORGANISMS, ALGAE,
2133 TOXICITY, OIL SPILLS, TANKERS, CLEANUP, ECONOMIC EFFECTS, DISPERSANTS,
2136 TOXICITY, REFINERIES, WASTEWATERS, OIL SPILLS, MONITORING, *RESEARCH PROGRAM, ENGLAND,
2152 TOXICITY, DRILLING, OIL WELLS, CONTAMINANTS, ENVIRONMENTAL EFFECTS, GROUNDWATER,
2223 TOXICITY, OIL TRANSFER, DECOMPOSITION, FRESHWATER, SEAWATER,
2[illegible]39 TOXICITY, BIBLIOGRAPHIES, ENVIRONMENTAL EFFECTS, FRESHWATER, FISHES,
2083 UK, BALLAST, POLLUTION PREVENTION, OIL-WATER SEPARATION, TANKERS, ESTUARIES,
2115 UK, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ORGANISMS,
2229 UK, CONTAMINATION, PAH, HYDROCARBONS, RIVERS, *POTABLE WATER,
1743 US, CHESAPEAKE BAY, OIL SPILLS, FUEL OIL, REGULATIONS, *US COAST GUARD,
1749 US, ECONOMICS, WASTE OIL, OIL DISCHARGES,
1886 US, INTERNATIONAL AGREEMENTS, POLLUTION PREVENTION, OIL SPILLS, RECOVERY, FRANCE,
2054 US, LEGISLATION, WASTE OIL, RECYCLING, REUSE, LUBRICATING OIL,
2150 US, LEGISLATION, LIABILITY, OIL SPILLS, INTERNATIONAL CONVENTIONS, *AQUATIC
2249 US, LEGISLATION, CONTINGENCY PLANNING, OIL SPILLS, *CEQ,
2251 US, LEGISLATION, POLLUTION PREVENTION, *EPA,
2254 US, LEGISLATION, LIABILITY, OIL SPILLS, TANKERS, PORTS,
2257 US, LEGISLATION, LIABILITY, OIL SPILLS,
2258 US, LEGISLATION, ENVIRONMENTAL PROTECTION, OFFSHORE-PRODUCTION, OIL TRANSPORT,
2259 US, LEGISLATION, POLLUTION PREVENTION, OFFSHORE-DRILLING, PORTS,
2261 US, LEGISLATION, PORTS, OIL TRANSFER, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
2264 US, LEGISLATION, PRODUCTION, EXPLORATION, OIL INDUSTRY, ENVIRONMENTAL PROTECTION,
2189 USSR, OIL INDUSTRY, REFINING, ENVIRONMENTAL EFFECTS, OIL DISCHARGES,
1773 WALES, MONITORING, COASTS, CONSERVATION, OFFSHORE DEVELOPMENT,
2096 WALES, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE MAMMALS, *GREY SEALS,
2088 WASHINGTON, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, *ALPINE HABITAT,
2106 WASHINGTON, BIOLOGICAL EFFECTS, OIL SPILLS, INFORMATION SYSTEMS, RESOURCE MANAGEMENT,
1749 WASTE OIL, OIL DISCHARGES, US, ECONOMICS,
1778 WASTE OIL, MONITORING, DETECTION, ANALYTICAL TECHNIQUES, *SEWAGE,
1796 WASTE OIL, MONITORING, CHEMICAL ANALYSIS, POLLUTION PREVENTION, NEW YORK, *BUFFALO RIVER,
1917 WASTE OIL, ABSORPTION, OIL SPILLS,
1956 WASTE OIL, WASTEWATER TREATMENT, EVAPORATION,
1963 WASTE OIL, WASTEWATER DISPOSAL, OIL INDUSTRY,
2010 WASTE OIL, RECLAMATION, RECYCLING, WASTE OIL TREATMENT, REFINING, DISPOSAL ,
2011 WASTE OIL, WASTEWATER DISPOSAL, REUSE, FUELS,
2049 WASTE OIL, LUBRICATING OIL, REUSE, FUELS,
2053 WASTE OIL, LUBRICATING OIL, REUSE, FUELS,
2054 WASTE OIL, RECYCLING, REUSE, LUBRICATING OIL, LEGISLATION, US,
2056 WASTE OIL, INFORMATION SYSTEMS, RECYCLING,
2057 WASTE OIL, RECYCLING, DESIGN-ENGINEERING, SKIMMERS,
2058 WASTE OIL, RECLAMATION, OIL INDUSTRY, *TESTING METHODS,
2059 WASTE OIL, RECLAMATION, RECYCLING, LUBRICATING OIL,
2060 WASTE OIL, RECLAMATION, REUSE, LUBRICATING OIL,
2101 WASTE OIL, BIOLOGICAL EFFECTS, CRANKCASE OIL, SOIL, PLANTS,
1983 WASTE OIL DISPOSAL, OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1992 WASTE OIL DISPOSAL, PETROCHEMICALS, INCINERATION,
2007 WASTE OIL DISPOSAL, SLUDGE, INCINERATION,
2008 WASTE OIL DISPOSAL, INCINERATION,
2017 WASTE OIL DISPOSAL, *COMBUSTION,
2025 WASTE OIL DISPOSAL, WASTEWATER TREATMENT, INDUSTRIES,
1960 WASTE OIL TREATMENT, EMULSIONS, OXIDATION, *DEMULSIFICATION,
1961 WASTE OIL TREATMENT, OIL-WATER SEPARATION, SLUDGE,
1972 WASTE OIL TREATMENT, INDUSTRIES, FILTRATION,
1989 WASTE OIL TREATMENT, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES, JAPAN,

1994 WASTE OIL TREATMENT, RECOVERY, DISPOSAL , LEGISLATION, GERMANY, WEST,
1996 WASTE OIL TREATMENT, WASTEWATER TREATMENT, RECOVERY,
2010 WASTE OIL TREATMENT, WASTE OIL, RECLAMATION, RECYCLING, REFINING, DISPOSAL ,
2024 WASTE OIL TREATMENT, WASTEWATER TREATMENT, FILTRATION,
2047 WASTE OIL TREATMENT, LUBRICATING OIL, RECLAMATION,
2048 WASTE OIL TREATMENT, REFINING, RECYCLING, LUBRICATING OILS,
2050 WASTE OIL TREATMENT, RECLAMATION, REFINING, LUBRICATING OIL, CONSERVATION, ECONOMICS,
2051 WASTE OIL TREATMENT, RECLAMATION, LUBRICATING OIL,
2055 WASTE OIL TREATMENT, LUBRICATING OIL, RECLAMATION,
1963 WASTEWATER DISPOSAL, WASTE OIL, OIL INDUSTRY,
1988 WASTEWATER DISPOSAL, GROUNDWATER, CONTAMINATION, OIL INDUSTRY, OKLAHOMA,
2011 WASTEWATER DISPOSAL, WASTE OIL, REUSE, FUELS,
2039 WASTEWATER DISPOSAL, REFINERIES, WASTEWATER TREATMENT, RECYCLING, SLUDGE,
2172 WASTEWATER DISPOSAL, DRILLING, OIL WELLS, ENVIRONMENTAL EFFECTS, LEAKAGE,
2275 WASTEWATER DISPOSAL, INTERNATIONAL AGREEMENTS, OIL DISCHARGES, EUROPE,
1955 WASTEWATER TREATMENT, REFINERIES, OXIDATION, PH CONTROL,
1956 WASTEWATER TREATMENT, WASTE OIL, EVAPORATION,
1957 WASTEWATER TREATMENT, REFINERIES, FILTRATION,
1958 WASTEWATER TREATMENT, BIODEGRADATION, FILTRATION,
1959 WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION, COALESCENCE,
1962 WASTEWATER TREATMENT, REFINERIES, CANADA, WATER QUALITY,
1964 WASTEWATER TREATMENT, REFINERIES, ENVIRONMENTAL MANAGEMENT, ECONOMICS,
1965 WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE, SKIMMERS,
1967 WASTEWATER TREATMENT, OIL-WATER SEPARATION, SLUDGE,
1969 WASTEWATER TREATMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, SHIPS, REFINERIES.
1970 WASTEWATER TREATMENT, SEDIMENTS, CLEANUP, OIL INDUSTRY,
1971 WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOCCULATION,
1974 WASTEWATER TREATMENT, POLLUTION PREVENTION, INDUSTRIES, PETROCHEMICALS,
1977 WASTEWATER TREATMENT, OIL-WATER SEPARATION, RECLAMATION,
1978 WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
1980 WASTEWATER TREATMENT, BALLAST, TANKERS, OIL-WATER SEPARATION,
1981 WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE, EMULSIONS,
1982 WASTEWATER TREATMENT, CONTAMINANTS, HYDROCARBONS,
1983 WASTEWATER TREATMENT, WASTE OIL DISPOSAL, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1984 WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION,
1985 WASTEWATER TREATMENT, REFINERIES, SLUDGE,
1987 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, COALESCENCE,
1989 WASTEWATER TREATMENT, WASTE OIL TREATMENT, OIL-WATER SEPARATION, REFINERIES, JAPAN,
1990 WASTEWATER TREATMENT, ADSORPTION, *ACTIVATED CARBON,
1993 WASTEWATER TREATMENT, REFINERIES, ACTIVATED SLUDGE , GUIDELINES,
1996 WASTEWATER TREATMENT, WASTE OIL TREATMENT, RECOVERY,
1998 WASTEWATER TREATMENT, CRUDE OIL, COAGULATION,
1999 WASTEWATER TREATMENT, OIL-WATER SEPARATION, ABSORPTION, COALESCENCE,
2000 WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2001 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
2002 WASTEWATER TREATMENT, PETROCHEMICALS, *VERMICULITE,
2003 WASTEWATER TREATMENT, REFINERIES, ACTIVATED SLUDGE ,
2005 WASTEWATER TREATMENT, INDUSTRIES, OIL-WATER SEPARATION,
2006 WASTEWATER TREATMENT, OIL-WATER SEPARATION, COAGULATION, COALESCENCE,
2009 WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION,
2013 WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION, FLOCCULATION,
2014 WASTEWATER TREATMENT, OIL-WATER SEPARATION, *PARAFFINIC HYDROCARBONS,
2016 WASTEWATER TREATMENT, REFINERIES, FILTRATION, COAGULATION,
2018 WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE,
2019 WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, FILTRATION,
2020 WASTEWATER TREATMENT, REFINERIES, PETROCHEMICALS, *BIOLOGICAL TREATMENT,
2021 WASTEWATER TREATMENT, OIL-WATER SEPARATION, ADSORPTION, FLOCCULATION,
2022 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, ADSORPTION,
2023 WASTEWATER TREATMENT, OIL-WATER SEPARATION, *COANDA EFFECT,
2024 WASTEWATER TREATMENT, WASTE OIL TREATMENT, FILTRATION,
2025 WASTEWATER TREATMENT, INDUSTRIES, WASTE OIL DISPOSAL,
2026 WASTEWATER TREATMENT, OIL-WATER SEPARATION, ABSORPTION,
2028 WASTEWATER TREATMENT, REFINERIES, FLOCCULATION,
2029 WASTEWATER TREATMENT, REFINERIES, TEXAS, *ACTIVATED CARBON,
2030 WASTEWATER TREATMENT, EMULSIONS, FLOTATION,
2031 WASTEWATER TREATMENT, *PHENOLS, REFINERIES, BIBLIOGRAPHIES,
2032 WASTEWATER TREATMENT, OIL-WATER SEPARATION, ADSORPTION,
2035 WASTEWATER TREATMENT, REFINERIES, WATER QUALITY, EUROPE,
2036 WASTEWATER TREATMENT, DRILLING,
2038 WASTEWATER TREATMENT, REFINERIES, EVAPORATION,
2039 WASTEWATER TREATMENT, REFINERIES, WASTEWATER DISPOSAL, RECYCLING, SLUDGE,

2040 WASTEWATER TREATMENT, OIL INDUSTRY, PETROCHEMICALS, JAPAN,
2041 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, DISPERSIONS,
2044 WASTEWATER TREATMENT, OIL-WATER SEPARATION,
2045 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, FLOCCULATION,
2046 WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, REFINERIES, PETROCHEMICALS,
2052 WASTEWATER TREATMENT, REFINERIES, REUSE, RECYCLING,
2148 WASTEWATER TREATMENT, CONTAMINANTS, ENVIRONMENTAL EFFECTS,
2260 WASTEWATER TREATMENT, REGULATIONS, GUIDELINES, REFINERIES,
2265 WASTEWATER TREATMENT, LEGISLATION, OIL INDUSTRY,
1962 WATER QUALITY, WASTEWATER TREATMENT, REFINERIES, CANADA,
2035 WATER QUALITY, WASTEWATER TREATMENT, REFINERIES, EUROPE,
2155 WATER QUALITY, OIL SHALE DEVELOPMENT, WILDLIFE, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES,
2191 WATER QUALITY, PRODUCTION, OIL INDUSTRY, *WATER RESOURCES,
2284 WATER QUALITY, INTERNATIONAL AGREEMENTS, POLLUTION PREVENTION, ECOSYSTEMS, RHINE RIVER,
1875 WEATHERING, OIL SLICKS, CLEANUP, GERMANY, WEST, *PHOTOCHEMICAL DISSOLUTION,
1896 WEATHERING, OIL SPILLS, CLEANUP, BOOMS, SKIMMERS, ABSORPTION,
1953 WEATHERING, OIL TRANSFER, FATE, HYDROCARBONS, PHYSICAL EFFECTS,
2211 WEATHERING, SOURCE IDENTIFICATION, SPECTROSCOPY, NARRAGANSETT BAY,
2221 WEATHERING, RESTORATION, SEDIMENTS, FATE, OIL SPILLS, CANADA, CHEDABUCTO BAY,
2233 WEATHERING, OIL SPILLS, FATE, ARCTIC, CLEANUP, SOURCE IDENTIFICATION,
2236 WEATHERING, FATE, OIL SPILLS, INLAND, BIODEGRADATION,
2237 WEATHERING, TAR, CHEMICAL ANALYSIS, *FOULING ORGANISMS,
2239 WEATHERING, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY, ENVIRONMENTAL EFFECTS,
2241 WEATHERING, OIL SPILLS, FATE, SPREADING, BIODEGRADATION,
2156 ZOOPLANKTON, BIOLOGICAL EFFECTS, OCS, OFFSHORE EXPLORATION, ATLANTIC OCEAN,

APPENDIX

Periodicals Reviewed

Abstracts on Health Effects of Environmental Pollutants
Alaska Seas and Coasts
Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Kommision für Merresforschung
Biological Abstracts
Bioscience
British Birds
Bulletin of Environmental Contamination and Toxicology
California Water Pollution Control Association Bulletin
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research
Ecolibrium
Ecological Abstracts
Ecological Modelling
Ecological Society of American Bulletin
Ecology Law Quarterly
Energy Review
Environment
Environment Abstracts
Environmental Action
Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control
Environmental Periodicals Bibliography
Environmental Pollution
Environmental Science & Technology
Environmental Technology and Economics
EPA Reports Bibliography Quarterly
Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoffchemie
Estuarine and Coastal Marine Science

Fuel Abstracts and Current Titles
Government Reports Announcements
IMS Newsletter
India Journal of Environmental Health
Industrial Wastes Information Bulletin
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Petroleum Abstracts
Iranian Journal of Science and Technology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health
Journal of Environmental Sciences
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Fisheries Review
Marine Geology
Marine Geotechnology
Marine Newsletter
Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Massachusetts Audubon
Microbial Ecology
National Fisherman
National Petroleum News
National Research Council, News Report
National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of Scientific Fisheries
Ocean Engineering
Ocean Industry
Ocean Management
Ocean Oil Weekly Report
Oceanic Abstracts
Oceanus
Offshore
Offshore Abstracts
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International

Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print
Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Sea Frontiers
Sea Secrets
Sea Technology
Selected References on Environmental Quality
Selected Water Resources Abstracts
Sierra Club, San Francisco, Bulletin
Technical Book Review
The Ecologist
The Engineering Index
The International Journal of Environmental Studies
The Sciences
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Water, Air, and Soil Pollution
Water Pollution Control
Water Pollution Control Federation, Journal
Water Research
WRC Information
Western Fisheries

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We are requesting your assistance upon receiving this report ("Oil Spill and Oil Pollution Reports, August 1976 - October 1976").

Is the information usable?
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We invite your comments and suggestions. Thank you.

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